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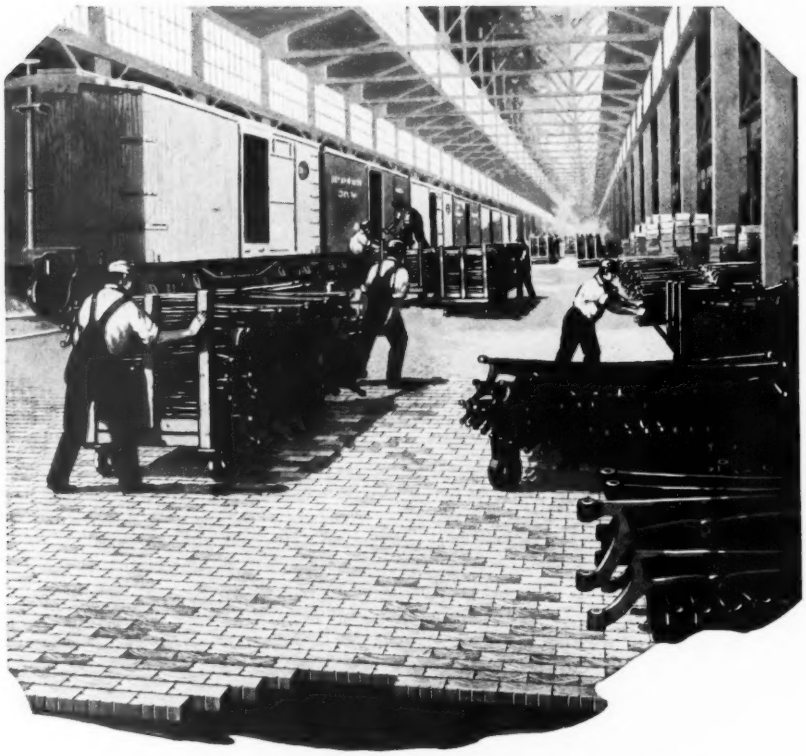

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A Notable Group of Authors

Harvey Wiley Corbett — Architect for Bush Terminal Building, No. 1 Fifth Ave. Apartments and Roerich Museum Apartments, New York. At present engaged in planning a new building for the Metropolitan Life Insurance Co. which may compare favorably in height with the tallest buildings yet built. Chairman of the architectural commission of the World's Fair in Chicago in 1933.

Blank & Stoller Photo

H. R. Dowswell—As an architect and engineer has been connected with the design of such well-known structures as the Canadian National Hotels, Toronto Union Station, Halifax Ocean Terminals, the General Motors Building and the Lefcourt National Building in New York and the R. J. Reynolds Tobacco Building in Winston-Salem, N. C. Recently, as an associate of the firm of Shreve, Lamb & Harmon, he has had charge of materials, methods of construction and specifications on two of the tallest buildings in New York City, the 500 Fifth Ave. Building and the Empire State Building. Mr. Dowswell is chairman, masonry section, building code revision of New York City.

Photo © Bachrach

Raymond M. Hood—Architect for the Tribune Tower in Chicago and the American Radiator Building, Daily News Building, Beaux Arts Apartments and McGraw-Hill Building in New York. Now engaged with Harvey Wiley Corbett in making designs for the Rockefeller Radio Center to occupy three blocks adjoining Fifth Ave. in New York. **J. André Fouilhoux**, who also contributes to this issue, handles the structural and mechanical problems for the firm of Raymond M. Hood, Godley & Fouilhoux.

John A. Sutherland and **F. A. Byrne**—Associated as chiefs of mechanical and electrical engineering for Holabird & Root, architects, of Chicago. Have been connected with the design of such projects as the Palmer House and Stevens Hotel, the Palmolive, LaSalle-Wacker, and Chicago Board of Trade buildings, and others which range in height from 30 to 50 stories.

W. A. Starrett—The firm of Starrett Bros. & Eken, of which Col. Starrett is vice-president, numbers among the recent notable buildings which it has constructed the 71-story Manhattan Company Building, the 85-story Empire State Building, and the New York Life Insurance Building in New York. Affiliated companies have erected well-known skyscrapers in Chicago, Cincinnati and elsewhere.

Kayden-Keystone Photo

David C. Coyle—As engineer with Gunvald Aus he developed the windbracing for the Woolworth Building tower in 1910. More recently he has designed such outstanding structures as the Ritz Tower Apartments, New York Life Insurance Building and Roerich Museum Apartments. Mr. Coyle is now in private practice.

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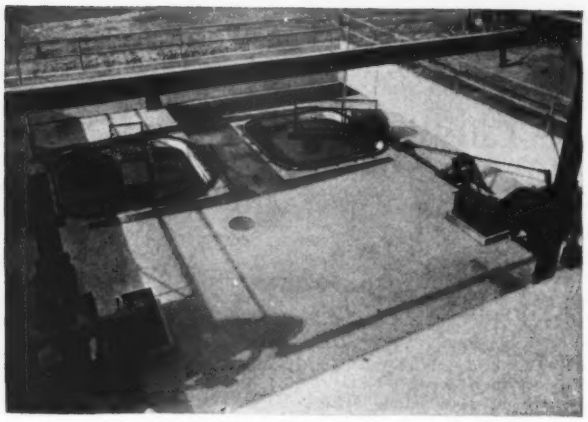

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

F. E. SCHMITT, *Editor*

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Crime Note

IMPROVEMENT of federal-aid highways and post roads "has aided lawbreaking and encouraged crime," asserts a concurrent resolution of the Iowa legislature; therefore, it resolves, the state should have "the aid and cooperation of the federal government that will bring relief in this extremity." Of course when one thinks of it that way, the surfaced road is as great an aid to the bank robber in making his getaway as to the farmer in going to renew his note. So far as is known, however, the Iowa legislature is the first to point positively to the improved road as an accessory to crime. Its naïve memorial also extends the boundaries of recent claims for federal aid by a wide margin.

Excess Earnings

THE Interstate Commerce Commission has undertaken to collect some $15,000,000 from the Norfolk & Western Ry. as "excess earnings." This with one hand; with the other hand it has written Congress a report saying how fruitless it is to attempt to collect excess earnings from the railroads and recommending that section 15a be stricken out of the interstate commerce act. Excess earnings as defined by the act are one-half of the amount by which a railroad's net income exceeds 6 per cent upon its "value for rate-making purposes." The commission has not yet succeeded in determining this value, as may be judged from the fact that, while its estimate of what constitutes excess earnings for the year 1926 is based on a value of $379,000,000, the railroad claims that it should have been based on a value of $742,000,000. Lawyers will have all of the $9,000,000 excess income for 1926 which the government expects to collect before that little difference of $363,000,000 is eliminated. The theory of recapture of excess earnings has so far failed, sufficiently to warrant the commission's proposal to abandon it.

Planned Public Works

LONG-TERM advance planning of public works, with a view to making them available for the relief of depression when the activities of private industry slacken, has been lifted out of the realm of academic discussion by an act of Congress passed and approved last week. The act creates a board which is to schedule federal construction for six years ahead. This innovation represents a constructive experiment. It may prove more valuable in its indirect rather than in its direct results, however. Some federal offices have resorted to advance planning in the past, notably the Reclamation Bureau, but generally such planning remained fruitless because not recognized officially. Even when official, however, federal advance planning affects too small a total of work to be significant in moderating depressions. Its greater value will lie in setting a model to cities and states and leading them to plan and budget their major improvements. City development in particular has long suffered from lack of planning, as we have many times pointed out. Yet even here the fact will remain that desires for public works have a way of expressing themselves at times and with a power that takes small account of even the best budgeted intentions.

Need for Water Planning

THOUGH all city improvements are sorely in need of advance planning, water supply offers the preeminent field. Adequate reasons may be found through the whole range of service, including supply, treatment, pumping and distribution; in each, a long look ahead is necessary if growth and variation of demand are to be served. But most imperatively does this apply to sources of supply, which are often involved in long delays. Witness the Boston supply, New York's Delaware River project, the needs of the New Jersey metropolitan district, and the hopes for better water in Philadelphia—to go farther down the Atlantic seaboard. The still continuing drought emphasizes the importance of supply reinforcement, larger factors of safety, and restudy of plans; and though pipelines, pumps and storage may get along on ten-year planning, supply sources are more safely based on a foresight of thirty to fifty years.

Prevailing Wages

EXPLOITATION of labor is always objectionable, and particularly so in the present stress of unemployment. Recognizing this the Senate has passed a bill of Senator Davis designed to maintain prevailing wages in federal building work. Unfortunately the Davis bill attempts to correct one evil by creating a far more menacing one. Confusion and increased costs on federal building work are sure to result. The bill would have all disputes settled by the secretary of labor, an official whose sympathies are naturally on the side of labor and who is not accountable for the cost of the work. Rightfully the Associated General Contractors has protested this provision and urged that, instead, the contracting officer be empowered to settle disputes. The A.G.C. further offers the sound suggestion that, under the proposed act, the minimum rates of wages to be paid on the job be specified in the call for bids. Otherwise it is conceivable that the wage rates might be raised by the labor department several times during the life of a contract; the contractor would be forced to bid—unintelligently—on such a possibility. "Prevailing rate of wages" is, under the best of conditions, an indefinite and intangible term. Under the proposed Davis bill it would be still more indefinite. For the good of the public as well as of an essential industry, the bill should be amended or killed.

Greater Building Heights and What They Mean to the Art

A GROUP of articles by keen minds in the field of tall building construction is brought together in this issue, to direct and guide progressive thinking on the transition from ordinary skyscrapers to superskyscrapers, one of the most perplexing phenomena of recent city growth. The five-year period just closed saw a new era begin, in which the 25- to 35-story limit that had prevailed for high city buildings gave way to a new range, from 60 stories upward. What does this change mean for the future? The articles in this issue discuss some of the factors involved.

ARCHITECTS and engineers encounter problems of first magnitude in the new development. So also do municipal engineers and transportation men, but for the time being these interests are secondary. Questions such as height limitation, bearing as they do on light, air, congestion and the structure of city life in general, will be timely when the architectural and engineering questions have been cleared up. We need to know what is feasible before we ask what is desirable.

The superskyscraper is more than a local issue. Thirty years ago many people believed that twenty-story buildings were of interest only to a few metropolitan centers, but that Atlanta, Seattle, Dallas and Toronto would continue to do their business at lower levels. Time has taught us better. The high peaks in the skyline of dozens of cities give proof of a more ambitious business demand. History may repeat itself. Potentially, therefore, the problem is of country-wide concern.

IN LARGE degree the modern tall building represents a dream come true. After Jenney's historic work, fancy dreamed of 200 ft., then of 500, then of height surpassing the Woolworth Building. Now some structures go 700 or 1,000 ft. into the air, one even 1,250 ft., nearly a quarter mile! But as dreaming and planning continue beyond this point, some doubt begins to be discernible, involving both economics and construction. Are still taller buildings desirable investments? Are they efficient in their utilization of space? Are their structure, their mechanism and production thoroughly evolved?

Regardless of the future course, the present position must be consolidated. We should know that existing methods produce structures capable of being lived in with comfort and that designing and constructing organizations are adequate to the most severe demands of today; we should understand clearly how materials limit the forms of design. How well the superskyscraper will serve human needs depends on thorough comprehension of these matters. Further, in view of the huge investments at stake, adaptability to changing environment may prove an important characteristic. The building of the future should be adapted to remodeling against obsolescence.

ORGANIZATION developments in the skyscraper field have been of decisive importance. The constructor's art, it appears, is ready for dimensions far beyond those yet reached. Also, the modern architect and engineer have become effective partners, each adapting his service to the joint need, and the builder has come into a new relationship to this group, functioning as adviser and trained purchasing agent. Even fuller evolution of this relation should come about in the future.

"No one man builds a building," said Col. W. A. Starrett recently. "It is the product of many hands *working together.*" The last two words express the essence of building progress. The pioneer who went into the forest, felled trees, squared them with a broadaxe and assembled them into the four walls of his dwelling, split shingles, and laid up a fieldstone chimney, truly was the builder of the house. But today the builder is coordinator rather than craftsman. He hews no wood and lays no bricks, but he plans that each craft shall come along at its proper time and work in harmony with others. Herein lies the success or failure of the modern builder. He builds well whose familiarity with the needs and problems of many trades makes it possible for him to direct and inspire them all.

NOTHING is more important to the tall building than its structural frame, and no single element of the tall building warrants more careful study on the part of structural engineers nor more wholesome respect on the part of architects. The towers of buildings one thousand or more feet high are subjected to forces alien to ordinary experience and largely unknown in character and action. Wind design, which in the past has often been of a perfunctory nature, thus becomes the critical element of the problem. Quantitative and qualitative data on wind forces at various heights assume importance. Knowledge of building behavior is another prime requisite, for if people are to work and perhaps live in tall slender towers, these structures must be comfortably habitable. Therefore not only strength and safety are involved, but deflection and vibratory movement become design criteria.

Wind design remains indefinite and controversial despite recent refinement. However, the interest lately displayed by a number of engineers, and also a few architects, in the investigation of building behavior is encouraging. Such investigation will not lead to formula methods of design, but it will aid in rationalizing present theories. The efficiency of the tall buildings of the future rests on such work.

ARE buildings going higher? That is beyond forecast. But further change may entrain far-reaching modification of structure. Already there are signs of revolution in wall design, a tendency to throw off the masonry influence and convert the wall into the drapery that it really is. Lightweight floors are being studied, and as both walls and floors are now relied upon to contribute rigidity to the frame the effect of their replacement by more flexible forms requires careful evaluation. Larger plots of land and reduced shaftway space for elevators may become controlling necessities. If double-deck cars or multiple cars win practical recognition, new arrangements of floor and frame may develop; still others if the continuous elevator, now just over the horizon, should emerge. These are some of the factors that may influence the form of the taller buildings of the future.

There has never been question, and there is none now, that taller buildings can be built and can be made a structural and mechanical success. But they will be built only if they can be shown to be profitable. Efficiency is the keynote of building promotion, and similarly must dominate the work of the architect and engineer.

The Future of the Tall Building

By HARVEY WILEY CORBETT,
Architect, New York, N. Y.

An analysis of present trends that points to shop fabrication of more elements, lighter and more open wall construction, possible changes in floor materials, more attention to rigidity, increased service facilities and greater cooperation among architect, engineer and builder

THE FUTURE of the tall building must by this time be resting in the lap of the gods if the ever-increasing height to which modern structures are reaching is any criterion. The French call our most distinctive engineering creation "grattes-ciel," which is more expressive than our own term of "skyscraper;" for at the rate we are going the sky is being more scratched than scraped. In fact, we seem to be itching with the idea that our ultimate architecture is all up in the air. No other view appears tenable.

All the work attendant to this development is so essentially engineering that every forward-looking engineer, especially if he is in the structural field, is eager to know what the future holds in store for him. Not many years ago I was frequently asked, "What is the height limit of the tall building?" Today I seldom hear that question, because apparently the man in the street has wisely decided there is no limit. He is now more inclined to ask, what is the economic limit of the low building? Demonstrating that the tall building, as a thing of economic business efficiency, has proved its value and is being viewed in its true perspective.

Result of setback zoning
500 Fifth Ave. building, New York
(Shreve, Lamb & Harmon, Architects)

I have claimed for some years that the tall building has served as our most important single source of traffic relief. This is in direct conflict with the opinion of many others who have pointed to the skyscraper as the source of all our traffic and transportation problems. Bassett Jones in a recent address before the New York chapter of the American Institute of Architects presented a few statistics to show that there are carried in elevators in New York, vertically speaking, just twice as many people per day as are carried on all the transportation lines of the city, horizontally speaking—including subways, surface lines, elevateds and taxis. To appreciate the importance of this one has only to imagine the chaos that would prevail if our cities were to be spread out on a six-story basis as Paris and London are spread out, and two-thirds of the population, which now moves with ease and comfort along vertical lines, were obliged to move along the old horizontal lines.

More Cooperative Planning

We may assume, therefore, that the future building is an economical, structurally sound and thoroughly practicable method of providing inclosed space for business and other purposes. Let us review for a moment some of the more particular aspects of the high building problem as it affects architects and enginers. When we stop to realize that this entire tall building period began less than 50 years ago, with the initial use of skeleton construction as a substitute for the masonry sustaining wall, and that active development could almost be said to be limited to the last 25 years, it is not surprising that we are at some loss to grasp its true significance or that the many agencies involved in these great structures are not in such complete accord as they might be. With the rapid development of the building industry, architects had structural and engineering complications thrust upon them at such a rate that an unfortunate division of interest seemed to grow between them and the engineer. While the architectural profession fully realizes that without the engineer the buildings would probably fall down, it also believes that without the comprehensive sense of arrangement and the esthetic value of good design, which the architect has the capacity to supply, the buildings would be taken down sooner than they are.

One of the aspects of the tall building problem then is the necessity for a higher degree of mutual understanding. Architects probably realize more fully than at any previous time that the success of our modern building projects depends upon the complete coordination of all the factors which enter into and become part of these great structures. The modern architect is a manufacturer of a commercial commodity known as "inclosed space" and can no longer regard himself as an individual artist, personally at ease in his studio, creating designs that are all of his own imagining. He must have a very general and technical knowledge of the market for the commodity which he produces, the cost of its production and

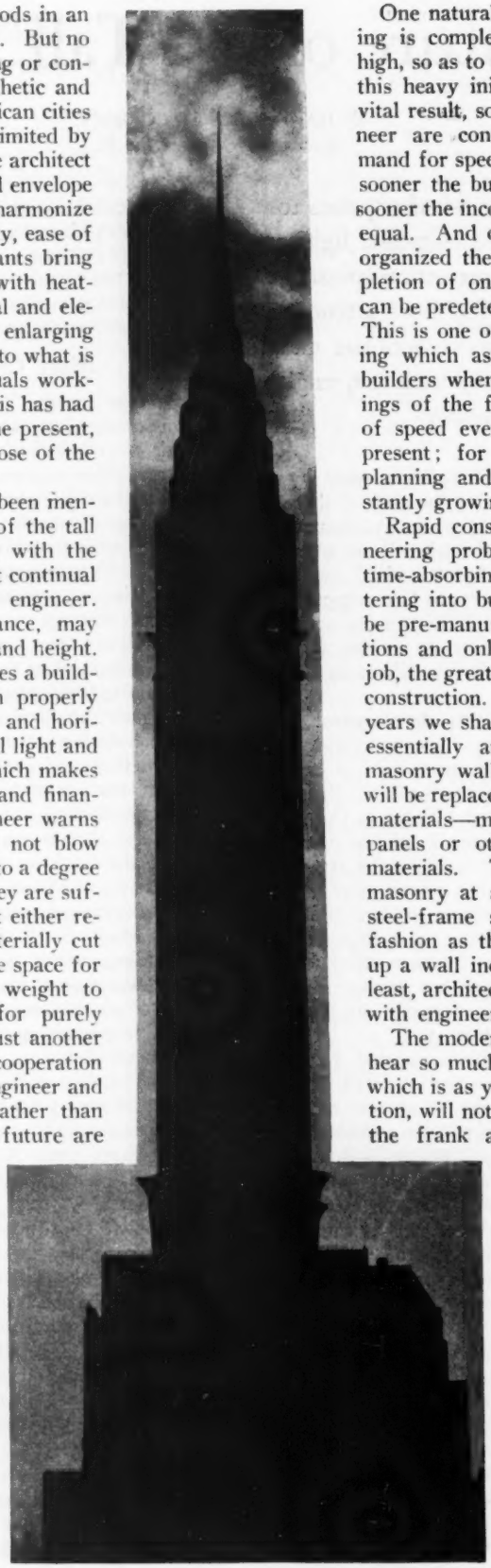
No setbacks required
Union Trust Building, Detroit
(Smith, Hinchman & Grylls, Architects)

the time involved in placing the goods in an attractive package for final delivery. But no longer is he free to plan the building or conceive of its design as a purely esthetic and architectural mass. In most American cities the exterior mass of buildings is limited by rigid zoning regulations, so that the architect must remain within a predetermined envelope and must scheme his building to harmonize with these limitations. Accessibility, ease of movement and convenience of tenants bring the architect in immediate touch with heating, ventilating, plumbing, electrical and elevator experts, so that he is rapidly enlarging his corps of aides and assistants into what is becoming a huge force of individuals working toward a common goal. All this has had a vital effect on the buildings of the present, and it most certainly will affect those of the future.

A most basic limitation has not been mentioned: No step in the planning of the tall building can be taken, beginning with the ground itself and going up, without continual consultation with the structural engineer. Foundation conditions, for instance, may radically affect plan, arrangement and height. In sketch form the architect pictures a building of impressive grandeur, with properly disposed spaces, adequate vertical and horizontal circulation, abundant natural light and outlook, all carried to a height which makes the building mechanically sound and financially possible. A structural engineer warns him that while the building will not blow over it may vibrate in high winds to a degree that will make the tenants think they are suffering nervous palsy, and he must either reform his building in plan and materially cut down its height or give up valuable space for necessary windbracing and add weight to walls and floors not required for purely structural stability. All this is just another evidence of the need of complete cooperation and understanding between the engineer and the architect, which will grow rather than diminish as the buildings of the future are planned and built.

More Speed

Most of the land on which buildings are erected in this country is freehold. In England, particularly in London, most of the land is leasehold. There the owner of the land recognizes the fact that the building operation is a long process, and the lessee pays his lease on a graduated scale, not paying the full rental until his building is producing income. The owner must assume the full burden of the property at its purchase price value and absorb the additional cost as the building progresses.



Buildings of the future will be larger and taller for reasons of business efficiency if for no other

One natural result is that once the building is completed rents are proportionately high, so as to amortize as quickly as possible this heavy initial cost. Another and more vital result, so far as the architect and engineer are concerned, is an increasing demand for speed in design and erection. The sooner the building is up and occupied, the sooner the income begins—other things being equal. And our builders have so efficiently organized the industry that today the completion of one of our enormous structures can be predetermined almost to an exact day. This is one of the facts of American building which astounds foreign architects and builders when they learn of it. The buildings of the future will reflect this element of speed even more than do those of the present; for carrying charges during the planning and construction period are constantly growing.

Rapid construction is essentially an engineering problem. Hand labor is always time-absorbing, and the more elements entering into building construction, which can be pre-manufactured under factory conditions and only assembled or erected on the job, the greater the facilitation to rapidity in construction. Undoubtedly in the next few years we shall see work on the site become essentially an assembly job. The heavy masonry walls now in almost universal use will be replaced by a light double shell of finer materials—metal, precast fireproof cement panels or other combinations of resistant materials. The piling of one block of masonry at a time on the 50th floor of a steel-frame structure in exactly the same fashion as the Egyptians in 6,000 B.C. set up a wall indicates that, in some respect at least, architectural practice has not kept pace with engineering invention.

The modern architecture about which we hear so much (and some of which we see), which is as yet purely superficial ornamentation, will not become truly modern until it is the frank and simple expression of the newer construction. The architect of the near future must of necessity work with the engineer and design his buildings with full knowledge of an appreciation for the esthetic and architectural values of the new rational and economic methods of construction and the new large-scale, factory-produced materials.

The large concentration of population, which is occurring in every city of importance in the United States and which incidentally is not the result of any limitation of the opportunity to spread out, as so many people suppose, is another problem which is daily

demanding more attention from architects and engineers, town planners and communities. The more people that can be concentrated for business or living purposes upon a given area of land—consistent with accessibility, ease of movement, light and air—the more facilities they will have for the transaction of business, the more easily they will make the necessary personal contacts and the less time will be lost in moving about.

In the last analysis the future of the tall building is purely a question of whether it increases business efficiency.

Buildings used to be regarded as permanent structures. The architect of a few years ago thought when he was erecting a building that he was creating a monument to his genius as an artist that would be admired by his grandchildren. Today, when he completes a building he tries to clinch the contract for the new building that he knows within fifteen or twenty years will replace the one he has just finished. Buildings become obsolete not because of failure of their structure but through changes in plan arrangement, mechanical facilities and efficiency. People like to be in new buildings just as they like to have new cars. More economic methods of building, lighter construction and increased re-use value of the materials may mean the scrapping of old buildings and completing of new ones at an even more rapid rate than at present. Changes in architectural style will then come in direct proportion to this speeding up of construction and demolition.

Height, numerous terraces and maximum window areas characterize Roerich Museum in New York, of which the firm of Helmle, Corbett & Harrison was architect and Sugarman & Berger associate architect.

Some Limits to Height

Each year buildings are better in plan arrangement, convenience, accessibility and mechanical equipment; also, in individual cases at least, they seem to get bigger. But there is a limit present in New York City in the size of the normal block, which is 200 ft. from street to street. Longer blocks are often available in other cities and in outlying sections of New York City, but extra tall and large buildings are usually not economically justified in such locations. Fifteen years ago the commercial building occupying an entire square was unusual. Today it is commonplace. And architects and engineers find that this limiting width of 200 ft. plus the restrictions of the zoning law, which permits a tower to occupy only one-quarter of the area of the plot after setbacks, brings very definite problems into the construction of the tall building and puts a limit on its possible height.

With present methods of construction and existing elevator equipment, something around 80 stories seems to be the economic limit to which a building may be carried. Changes in materials and their use, both in floors and walls, will produce great economies in weight and a corresponding saving in cost, as will the utilization of prefabricated units that tend to make the building an assembly job. This will make for larger buildings but not necessarily higher ones.

Two serious factors affect height: rigidity is one, elevators the other. If the structural engineer can secure rigidity in the steel frame itself and not depend, as he now does, on weight of floors and walls to prevent vibration, then builders can take advantage of new materials and new methods of construction. But in the last analysis steel is an elastic material, and these tall buildings tend to vibrate as does a tuning fork. Weight, more than is necessary for structural or wall-inclosure purposes, has to be added to prevent this vibration. The determination of the proper and economic amount of weight is the future problem to which the structural engineer should give great attention.

In the matter of elevators, which almost more than any other factor limit the height of buildings, rapid progress is being made. Double-deck cars have been proposed and provided for in at least one building. Two independent cars are now being operated in a single elevator shaft. It has been suggested that plaza floors be utilized for transfer from express to locals, so that the maximum speed and minimum loss of time in delivering local passengers to their floors will be effected. There is no doubt that elevator equipment will keep pace, as it has in the past, with increasing building height.

It is self-evident that we cannot continue to build up story after story and expect our present street capacity to supply the space necessary to provide these numerous buildings with adequate access. It is very much the same thing as increasing the size of the roof tank and still feeding it with a 1-in. line. Multi-storied streets are the necessary concomitant of multi-storied buildings. The present street capacity in the gridiron area of Manhattan Island is one acre of street for every two acres of building. We might assume that this would comfortably care for an average of twenty stories, but if we raise this average to forty we must certainly double the street; and if we do, then I sincerely trust that in the doubling or trebling process we shall divide traffic into its three logical levels of pedestrian, rail and wheel.

All these problems are immediately ahead of architects and engineers. The prospect is fascinating, intriguing and encouraging for any one who looks forward to doing things differently and better. The architect should remain the guiding force in the great building expansion immediately ahead of us. I say this not because I feel the architect is in any sense superior either in training or capacity to the engineer, builder, mechanical experts or others engaged in this work, but it just so happens that he is the one of the many factors brought together in the building field who is not more interested in one particular aspect of the problem than in any other. To meet his responsibilities he must have a breadth of vision, a genius for coordinating all the various interests and an enthusiasm which will inspire owners and enthuse the public.

Measuring the Behavior of Tall Buildings

By David Cushman Coyle
Consulting Engineer, New York City

With a recently developed seismograph, building stiffness as expressed by the amplitude of vibrations caused by wind gusts may be quantitatively recorded, pointing the way toward a rational basis of tall building frame design

IT IS apparent that the practice of tall-building construction is rapidly outrunning our knowledge of the actual behavior of these structures in practice. We know that there have been no spectacular collapses of high towers, but we know very little else in the way of definite check on current design practices. The large crop of new theories for wind design indicates that the profession is conscious of the fact that we have outgrown the old approximate methods; but it is not always apparent that we yet realize the extent of our ignorance in regard to the factors which should be taken into account. This paper is a preliminary report on a series of observations looking toward an ultimate increase in our knowledge of one of these factors.

A Horizontal-Pendulum Instrument

During the past two winters the writer has been studying, as opportunity offered, the harmonic vibration of New York tower buildings. It was necessary to build a preliminary instrument to get a line on the limits of period and amplitude to be observed; and then to develop a more suitable machine which would give accurate results within these limits. With the latter, a portable horizontal-pendulum seismograph, many observations were made during the past winter.

In Fig. 2 the essential parts of the instrument are shown in plan and section. As the building vibrates in a complex horizontal motion, the component of the motion perpendicular to the arm of the pendulum imposes a varying series of accelerations upon the lead bob which is free to swing to and fro about the knife edges as a center. The line through the two knife edges is necessarily not exactly vertical (if it were, the bob would wander and strike the side of the case), but is tilted slightly toward the bob, so that the path of the bob is very slightly concave upward, causing it to oscillate like a vertical pendulum with a slow period. The motion is recorded by a ruling pen which is counterweighted so as to touch very lightly the paper on a moving drum.

The friction of the pen is presumably very nearly constant at varying speeds, and it is sufficient to prevent the bob from making more than two free swings before coming to rest. The friction in the knife edges is apparently much smaller. The proper period of the pendulum, with the pen not in contact, varies from 8 seconds for long swings to 6½ seconds for short swings. The set-up is made by leveling the instrument so that the bob is in the middle of the drum and the bubble at a constant mark; the factor determining the proper motion will then be the same for all observations.

In view of the difficulty of evaluating the various factors no attempt was made at a theoretical determina-

Fig. 1—Southern end of Manhattan Island as it is today

New York City's skyline is now pierced by many peaks exposed to the wind. Ten years ago only the Woolworth and Singer towers were outstanding. The Woolworth and Metropolitan Life buildings at the top of the page are notable for their rigidity.

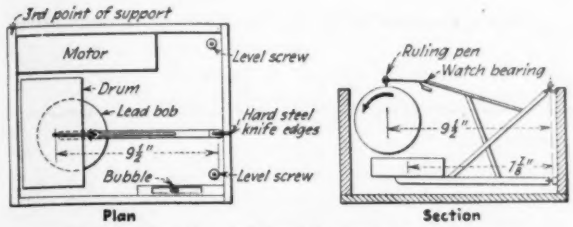


Fig. 2—Details of vibration-measuring instrument

Horizontal oscillation of load bob caused by building vibrations are recorded on a paper attached to drum.

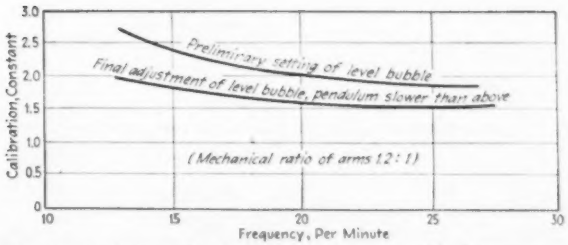


Fig. 3—Variation of calibration "constant" with frequency

Values of constant, which is ratio of recorded to actual amplitudes, determined by a special vibrating table.

tion of the calibration "constant," but the instrument was calibrated on a vibrating table. This table consists of two pieces of plate glass, the upper one of which is caused to slide to and fro along a straight-edge while supported on small brass rollers between the two plates. Observation under the microscope indicates that the motion is a straight line without rotation about a horizontal or vertical axis. An arm fastened to the bed plate carries a pencil which marks the true motion on the drum of the instrument. The instrument, being set on the moving plate and leveled, is allowed to record the motion, while the pencil attached to the base makes a simultaneous record of the imposed actual motion. By comparison of these curves the calibration factors for different frequencies are determined, and a number of these factors are shown on the calibration curve, Fig. 3. It will be observed that this curve rises toward the slower frequencies and is probably asymptotic to a line representing the proper frequency of about eight vibrations per minute.

As originally constructed, the lower sheet of plate glass of the vibrating table rested on a third sheet, and was arranged to have a simultaneous harmonic motion at right angles to that of the upper sheet. It was found that the calibration factor, as regards the component of motion perpendicular to the pendulum, was not appreciably affected by motion parallel to the pendulum, unless the latter was very violent. The conclusion was drawn that in case of a long narrow building the vibration readings for motion parallel to the long side might be vitiated by disturbances due to the violent motion in the weak direction, but the reverse would not occur. As the slight motions occurring in the strong direction are of comparatively little interest, the point was considered unimportant, and the secondary vibration apparatus was discontinued in the later calibration tests.

Interpreting Instrument Readings

From a large number of calibration readings it is apparent that the ratio between observed and actual amplitudes is not affected to a practical degree by variations in the amount of ink in the pen or the sharpness of the knife edges, or by any other factor which varies in practice. When a sudden change in acceleration occurs, the curve is exaggerated, but when running evenly it represents a practically accurate picture of the true motion. Typical calibration readings are shown in Fig. 4. The frequencies, of course, correspond exactly.

An essential feature of this instrument is that it is readily portable and quickly set up. This enabled me to get readings on as many as ten different buildings in the same day. One particular building was used at the beginning and end of every series to serve as an indicator of the violence of the wind. There is naturally no guarantee that the wind has not varied from hour to hour and from place to place. Moreover, the exposure of

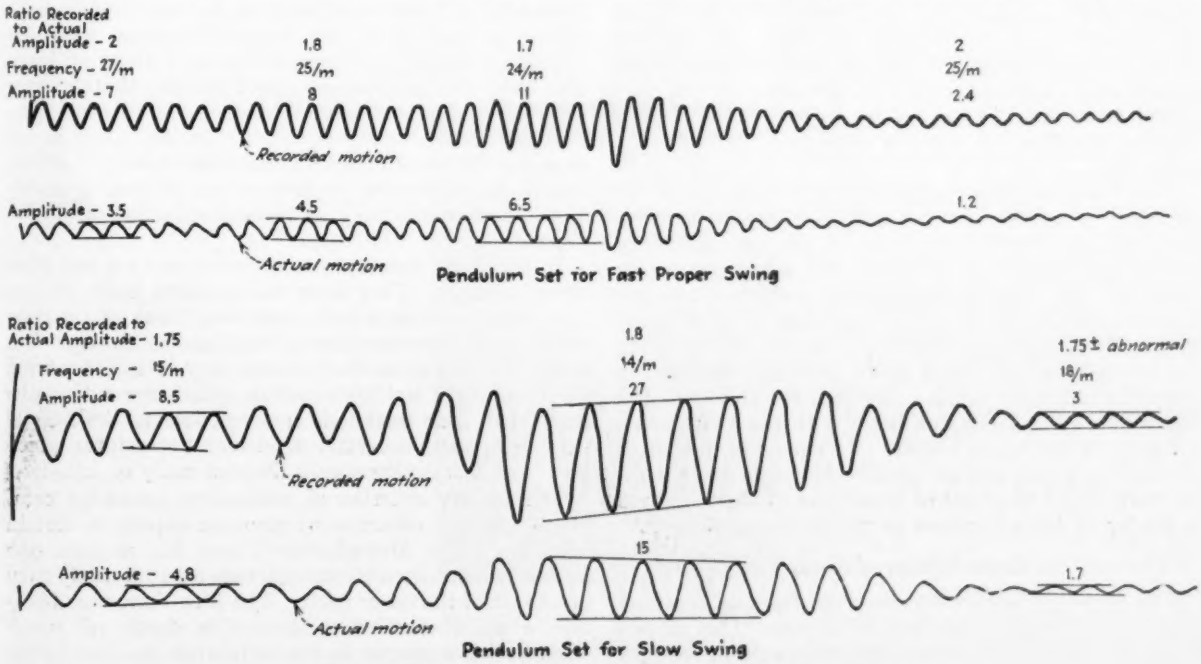


Fig. 4—Typical calibration readings for vibration instrument

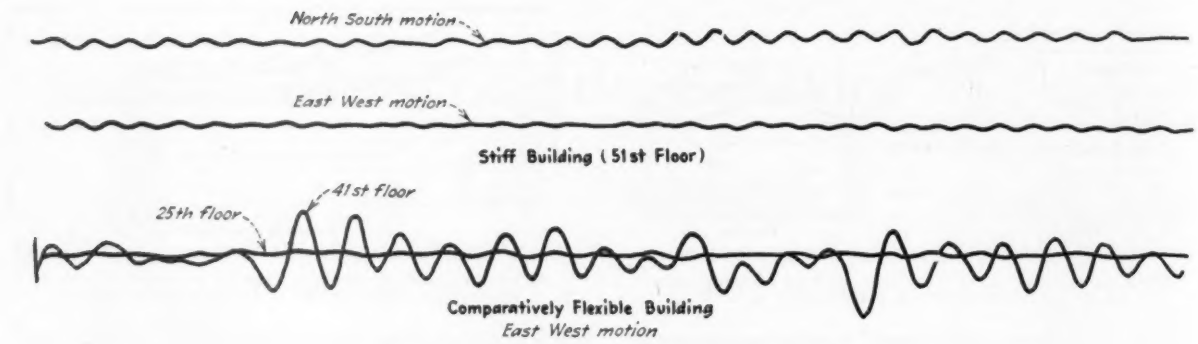


Fig. 5—Vibration curves for two New York buildings

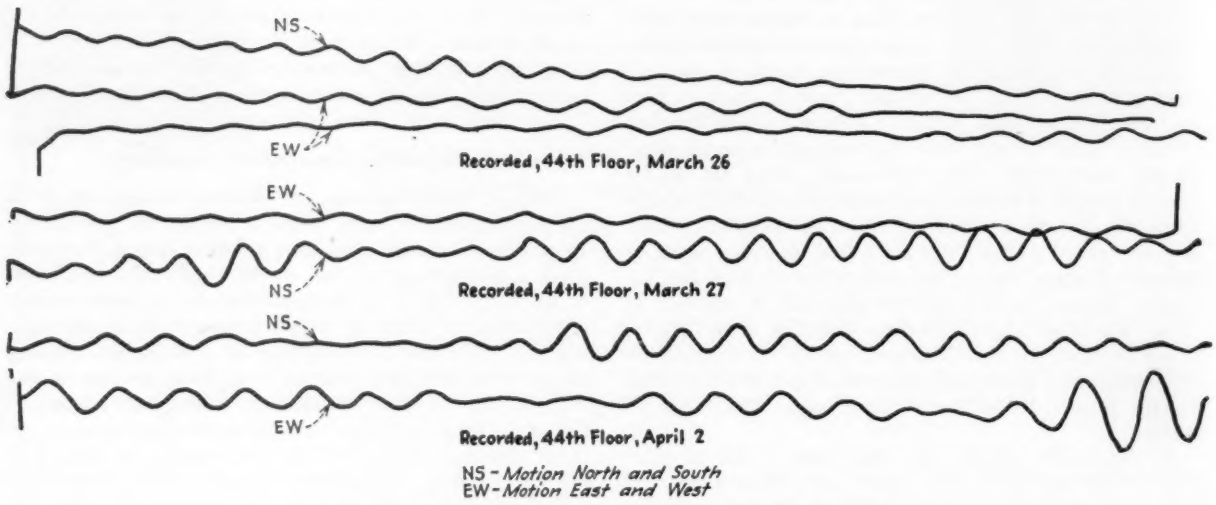


Fig. 6—Vibration curves for same building in different winds

each building varies from every other, and the exposure is different for each building with every shift in the direction of the wind. The wind pressure is not the factor which produces the vibrations; they are caused by the variation or gustiness of the wind; and no better method of measuring this quantity has occurred to the writer than to take readings of vibrations in one particular tower until he can tell by a given curve for that building whether the wind is very gusty or not on a given day.

It is therefore obvious that the amplitudes shown by the curves are to be looked at in a broad way, not microscopically, as accurate measures of the motion. They vary from moment to moment, the forces producing them are not directly measurable, and they are not precisely comparable with readings taken in other buildings. The frequencies, however, are practically exact, are nearly constant for a given building, and bear a rational relationship to the stiffness of the building. The amplitudes are roughly consistent with the frequencies, which is all one would expect. Variations in the length of wave are small, and are apparently due to gusts striking the building in or out of phase, and to slight changes in the lag of the instrument as the amplitude changes.

Some Observed Facts

The observed frequencies run from fourteen complete vibrations per minute to forty per minute. One or two of the new towers are slower, one being as slow as eight per minute. Faster motions are associated with amplitudes too small to register on this instrument and a new instrument will be required to get an accurate idea of the amplitudes for the slower buildings. The amplitudes observed in ordinary northwest winds run from a half-swing of about $\frac{3}{8}$ in. at fourteen complete vibrations (double swings) per minute to nearly nothing at forty. One lucky shot in a summer squall indicated that this type of wind may give amplitudes nearly double those produced by an ordinary northwester. In any case it is evident that the sway of several inches attributed to certain towers by newspaper writers is an illusion, probably caused by resonant swaying of hanging lamps and similar objects.

In Fig. 5 are shown characteristic curves for two New York buildings. They show that buildings differ in type of motion and that a sufficiently large mass of readings would enable one to classify buildings as more or less stiff. Existing New York towers vary in stiffness from the Woolworth and Metropolitan, which are stiff in the sense that their motion is imperceptible to the normal nervous system, to certain more recent structures which have a motion during squalls that can easily be felt.

The sensory criterion of stiffness is somewhat complicated by the existence of resonant objects in certain buildings. The Metropolitan Tower has at least one lamp which swings with an amplitude approximately fifty times that of the tower itself. The Ritz Tower has bathtubs which when filled to about 4 in. depth will run a resonant wave several inches high while the half-swing of the building is about $\frac{1}{16}$ in. The fact remains, how-

ever, that it is easier to correct or explain such action than an actual sway which can be felt as such without any help from the imagination.

Fig. 6 brings together a number of curves for the same building in different winds, showing that the curves remain similar in type and general appearance.

The results of these observations so far indicate that it is possible by one reading on a new building to get a rough idea whether its windbracing is good, bad or indifferent, and that a series of readings will enable one to classify the building pretty closely. This classification will enable the engineer to get some idea of how the various types of bracing utilized to date have worked out in practice.

The number of engineers who can study the subject is necessarily limited by the fact that no such list of buildings can be published for obvious reasons. The same applies to the other data which it will be desirable to collect before a final formulation of any satisfactory wind theory.

Additional Observations Required

There are several other types of observation which need to be made:

1. We need to know how far a tower leans to leeward under the total wind pressure. The relation between this quantity and the type of vibration curve may be simple or not; no one knows. As this static deflection is very likely several inches or feet for our tallest towers, of course no owner is likely to allow the publication of any data which may be obtained; but it is necessary that some discreet committee should examine such data, before the cantilever bending theory recently published by H. V. Spurr, and the most interesting development of recent years in the practicable theory of high building design, can obtain a satisfactory empirical background.

2. We also need to find out whether the upper floors of tall buildings remain plane under wind loading. If they do not, whatever theory was used in the design is obviously to be reexamined with some care. Spurr's theory pretends to insure that the floors will remain plane, so far as wind action is involved. Will they do so? The various slope-deflection methods assume that the floor remains plane, without any provision for making it do so. What really occurs in such a case, and how does it affect the theory? No one knows. It is evident that if the load distribution is such that a given joint is thrust up or down a half-inch with respect to the adjoining joints, no elastic theory which fails to take this distortion into account can be called accurate.

3. It will also be interesting if readings can be obtained showing the actual wind pressures simultaneously at various points of a high tower, together with their rate and extent of variation. Such readings, if coordinated with deflection and vibration data, would make it possible to express the theory in units which perhaps might have a recognizable relation to actual loads and stresses. This latter point is, however, of minor importance. The essential is to develop a relation between a nominal assumed load and a nominal assumed deflection which will result in a building of satisfactory stiffness. The absolute value of the wind pressure is important only for checking our present practice with regard to stability against overturning.

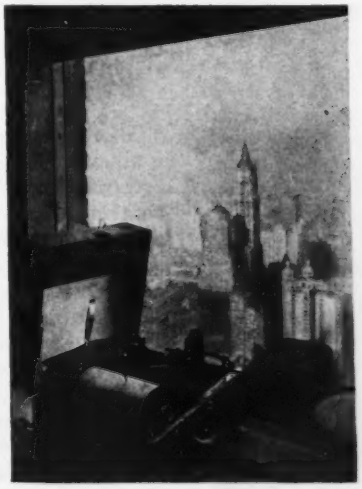


Fig. 7—Vibration-measuring machine

View shows set-up on windowsill of 60th floor of Manhattan Company building, New York. Woolworth Building in background.

What We May Learn

Few towers, if any, so far have been designed by a method which permits a close computation of their theoretical stiffness. As the new theory develops and buildings are constructed which have a definite theoretical deflection, it will be possible to estimate closely the effect of the masonry and partitions. For even without a knowledge of the force of the wind, it is possible to measure the stiffness by means of the vibration frequency, and the difference between the theoretical frequency (due to the steel frame) and the observed frequency will correspond to the effect of the factors not taken into the theory. This information will be of vast importance if the use of light walls should become general.

Here it should be emphasized again that we must not be led astray by data as to observed wind pressures and velocities. It is only necessary to consider Spurr's "allowable deflection" of 2 ft. for a 1,000-ft. tower to realize that we are necessarily dealing with nominal quantities. However closely we may correlate these quantities with observed pressures and deflections, the final arbiter is the human nervous system, and we must meet the requirement that the vibration must not be unpleasant. We can observe existing frequencies and amplitudes and existing steel designs, but as we do not know the effect of the masonry we cannot yet tell the true relation between them. A nominal static deflection of 2 ft. in 1,000 ft. may be correct for a building with brick walls, but how much vibration it would get if glass were substituted for the masonry is so far a pure guess. If we confuse these nominal quantities with absolute true quantities we shall suffer the usual penalties which come to those who allow the beauty of their mathematics to conceal the insufficiency of their data. Let it be thoroughly understood that if we change from the old materials or type of construction without knowing the extent to which these materials affect the stiffness, we must go by guess until we have actual test data.

It is encouraging to know that arrangements have been made for taking stress, deflection and wind pressure readings on a tower in Columbus, Ohio, and on at least one tower in New York. It is naturally very difficult to obtain the consent of owners to the taking of such observations, but if the art of tower building is to progress at all, it is of prime importance that no opportunity for the accumulation of data be neglected. Where the owners are progressive-minded men, and where the vibration readings show that the characteristics of the building are fit to print, it should be possible to get permission to make observations and publish them. Until that is done, any further refinement of the mathematical methods will merely serve to conceal our lack of progress. A study of the behavior of tall buildings is the next necessary step in their development.

Behind the Scenes in Building Planning

Modern buildings are planned in conference and designed by a cooperative organization, including not only the architect and engineer but the general contractor, whose loyalty is assured by a cost-plus contract

By RAYMOND M. HOOD
Architect, New York, N. Y.

American Radiator Building, New York

Raymond M. Hood, Architect

MODERN building planning and design are today expressed in a technique both different and more efficient than that used as recently as ten years ago. In principle, the procedure of developing a finished plan from an owner's embryonic idea, or, as often happens, from a group of apparently conflicting ideas, is not much different than it ever was. In reality, the procedure has had to yield to many modern influences, among the most compelling of which are the necessity for speed in getting the project under way and the need of rigid economy in both the design and the actual construction. The net result has been a remarkable development in cooperative work among owner, architect, engineer and contractor, to the end that our modern skyscrapers are actually planned in conference.

The cooperation now existing among the architect, the engineers and the contractors on a big building project can best be explained by describing the development of a particular job. The Daily News Building, in New York City, is perhaps the best of our recent jobs to select as an example. Although not one of the very large buildings in the city, it is large enough so that we encountered the bulk of the difficulties common to huge skyscraper planning, and, thanks largely to the owner, it was possible to organize the work systematically.

Raymond M. Hood, Architect

The Tribune Tower (right), Chicago

The job was brought to us approximately one year before we started work. Incidentally, this is an exceptionally intelligent plan for any owner to follow, for there is nothing that will insure a well-studied and economical project more than to provide ample time for its study. The general contract for the building, a cost-plus agreement, was entered into at the same time as was the contract with the architect.

Advantages of Cost-Plus

Many people have the feeling that the cost-plus method is an extravagance, and that it is much shrewder business and proves much more economical to let a job on a competitive basis. This may have been true twenty years ago, but experience today indicates that the cost-plus method, always assuming a contractor of proved experience and ability, is the best method of handling important work. In point of economy alone, the use of a cost-plus contract assures the greatest saving. In addition, it is the only system that enables the owner and architect to control the selection of materials and subcontractors. And, from the point of view of the study of a project, it gives the architect and the owner the benefit of the contractor's knowledge from the very beginning of the planning.

On buildings which utilize a cost-plus contract, drawings and decisions are not based alone on the architect's or the owner's relatively limited experience in

buying, but on the vast experience of a contracting organization that is in the market every day in the year. In other words, having the contractor on a cost-plus basis from the beginning, the owner has brought into his organization at once the services of a highly experienced purchasing agent.

It has usually been assumed that a job on a cost-plus basis loses the advantages of sharp competitive bidding and bargaining. This again is not true, for from 80 to 90 per cent of the work on every building is sublet by the general contractor on exactly the same competitive basis that it would be if the contractor himself were bidding on the job in competition. Therefore, even if there were a tendency in the contractor's organization to take a job easily, it could only affect his portion of the work—seldom more than 10 to 20 per cent of the total job. Under any condition this could make no more than a slight difference in the total cost of the building, say 1 or 2 per cent. And this loss would very probably be outweighed by the economies resulting in the design of the building when the architect is allowed the cooperation with the contractor that is his under a cost-plus agreement.

The large contracting companies of today are not the hard-boiled organizations that they were a generation ago. They are not traders but are highly experienced, efficient professional groups. They make their money, not by rolling the owner, but by the quality of their services. The methods under which present-day contractors do business go farther toward insuring efficiency and economy in the building field than any other single factor.

Planning in Conference

The cooperation between the architect and the contractor has been emphasized at some length because it is the basis of the relationship that exists between the engineer and the architect. No longer does an architect shut himself up in his office to make a design and send it out to a contractor to build or to an engineer to fit up with plumbing, heating and steel as best he can. Today everyone works together. The architect does not go up to a communion on Mount Sinai and hand out the results to the owner, the engineers and the public. Instead, he has found that cooperative action with these very people produces better results. Consequently, modern designs come from a group of minds in which the architect is one link in the chain.

Daily News Building

The planning of the Daily News Building benefited from these enlightened methods. The first conference in our office was attended by the owner, the general contractor, the real estate and renting agent and the plant-equipment engineer. This group worked continuously and criticised plans that were presented by the architect. All sorts of schemes were considered. The architect did not impose his idea of an exterior or an architectural effect upon the conference. The renting agent did not consider his ideas of proper layout, window spacing and distribution of space to be inflexible. Nor did the contractor insist upon certain materials and methods of construction. Every decision was arrived at in frank and open discussion. The elevator man was brought into the picture very early, and at about the same time the structural engineer and the heating, lighting and plumbing experts joined the conferences. In fact, not more than two or three weeks had elapsed before the entire group was complete. Everyone attended every conference, and no decision was made or imposed from any quarter.

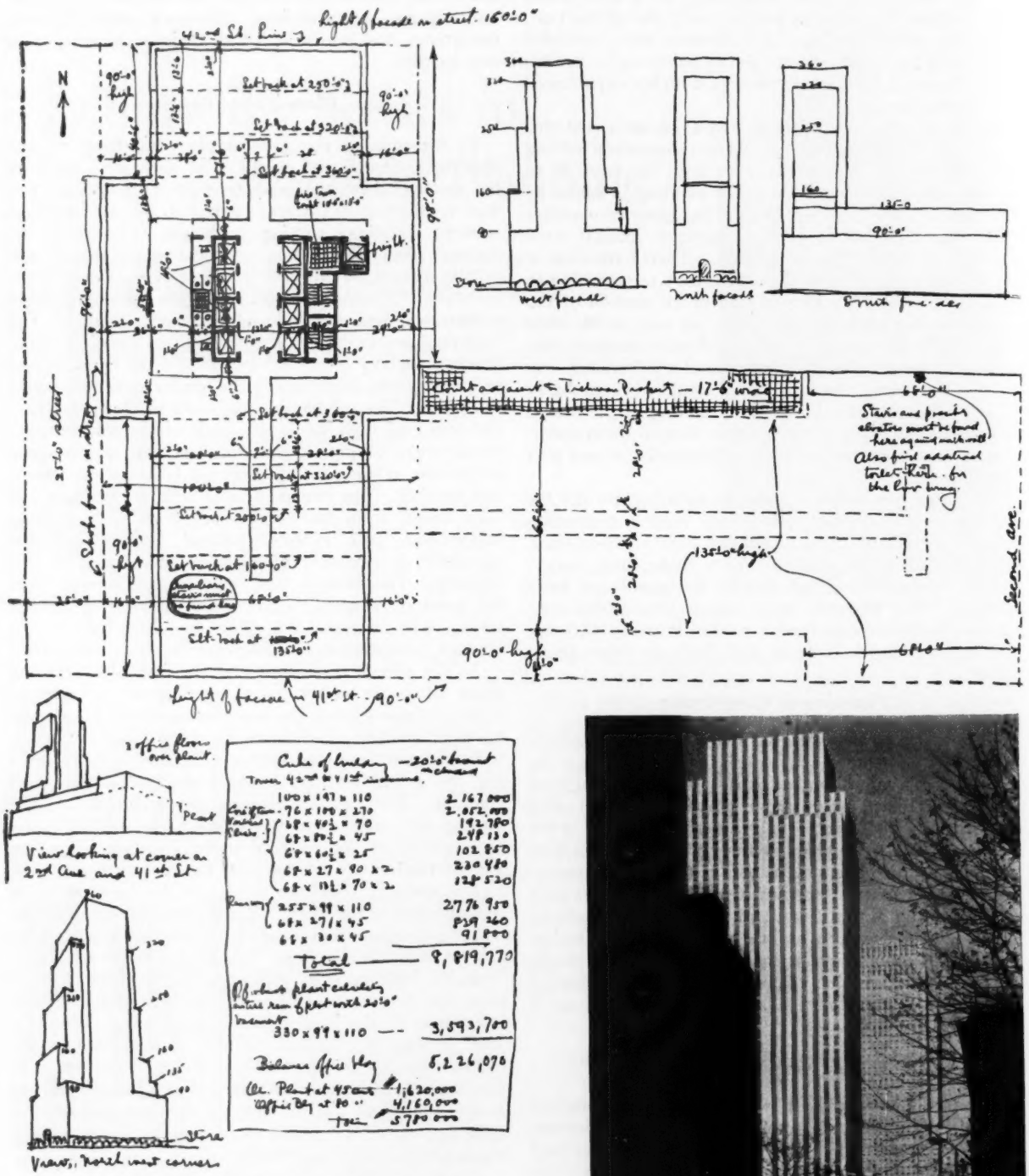
Plans Take Shape

In determining the general plan and mass of the building, estimates and checks of all sorts were made on the various schemes. Every possible court arrangement was tried, sketches were submitted by the architect showing buildings varying in height from 20 to 60 stories. And all of these schemes were analyzed and criticised from the different points of view of each of the interests. The general contractor gave the approximate volume and total cost of each scheme submitted. The steel engineer analyzed the difficulties of framing, windbracing and any conditions resulting from deep girders or framing that might injure the quality or rentability of the space. The mechanical engineers similarly analyzed the fitting of their work into each of the schemes, the arrangement of pipe shafts, together with approximate differences in costs, if they occurred, between one scheme and another. The real estate and renting man analyzed each layout from the point of view of office renting, subdivision, bulk renting, natural lighting and the necessary development of corridor space to serve the building. The elevator man analyzed each scheme from the point of view of ordinary and high-speed service, taking into account the probable character of the tenancy, according to the judgment of the renting agent.

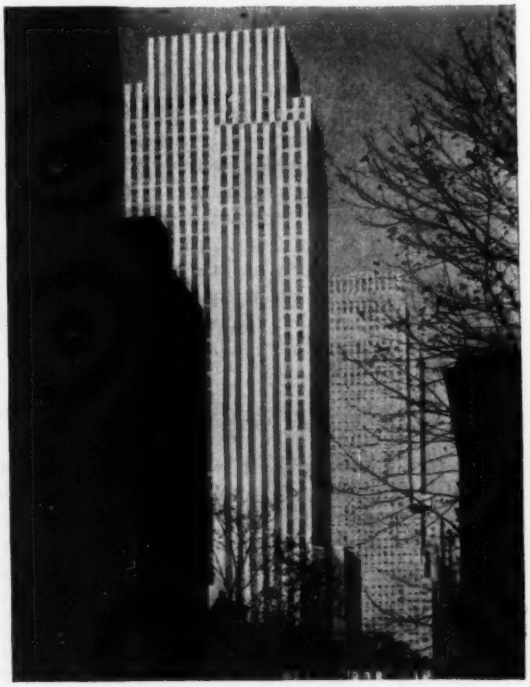
As the scheme developed and the preliminary sketch sheet, shown in an accompanying illustration, began to reflect definite figures, the conferences went into one detail after another. Every possible material for the floors, walls and partitions was discussed, the contractor furnishing the prices and information about deliveries and erection. The mechanical man, the architect and the renting man added their knowledge as to suitability and acceptability of the material under discussion, its cost and its relation to the rent that the tenants would pay. Every unusual condition, such as the location of a pressure tank, of a special piece of framing or a ventilation requirement that created an unusual condition in any part of the building, became a subject of study. Thus the building grew under the hands of all of these men, and no one could say that he played the biggest instrument in the band or made the loudest noise. In fact, it was the business of this conference and the business of the architect, as the leader of the band, to see that each man played in tune and that they all worked to a common end—to produce the best building—rather than that each man should try to use the job to make a display of his wares and abilities.

Interior Determines Facade

Obviously, under such a procedure of modern building planning as has been described, the architectural detail of the facade is one of the last determinations that is made. Rather than being the basis of the planning, it results naturally from it. In the Daily News Building a window was required for every 9 ft. of wall space. With such a spacing of windows the logical design was to emphasize them as vertical stripes separated by the white stripes of the column pilasters. In two other recent buildings, the Beaux Arts Apartments and the new McGraw-Hill Building, also in New York, a hori-



Facsimile of original planning sheet, Daily News Building



The Daily News Building complete

Vertical striped facade a natural result of interior requirements which fixed window spacing.

zontal rather than a vertical stripe facade was inevitable, due to the fact that a maximum of glass inclosure was desired. With virtually the entire front of every floor taken up by windows, the spandrels naturally stand out as horizontal stripes.

This discussion of building planning should emphasize that under modern procedure, made necessary by the size and complications of the structures, there can be no differences in the points of view of the architects and the engineers. If any one of the various parties identified with any project should step forward and assert his own interest, the project would suffer. By the same token, if each plays his part well, our modern buildings cannot help but be a success.

Drawings, Specifications and Inspection

By J. ANDRÉ FOUILHOUX
Raymond M. Hood, Godley & Fouilhoux, Architects, New York, N. Y.

THE following article is in effect a continuation of Mr. Hood's discussion on the several preceding pages. Preliminary conferences having fixed the general requirements, the stage is set for actual design work to begin. Mr. Fouilhoux sketches the steps taken by the architect and engineers between approval of sketch plans and completion of the building. His is a condensed, factual account of the types of drawings required, the methods of their preparation, and the inspection and supervision given the work in the field. —EDITOR.

THE COOPERATION and mutual understandings that are so important during the early stages of planning of tall buildings become absolutely essential when the actual design work begins. Architectural, structural and mechanical drawings must be started at once and carried on simultaneously. The architectural drawings are basic and affect all other designs, but they can be developed only with knowledge of the structural and mechanical requirements and limitations. A description of the customary procedure will make this clear.

Preparation of Drawings

After the owner's requirements for a building have been thoroughly investigated and incorporated in an approved sketch it becomes necessary to translate to paper, in the shape of drawings and specifications, all the information that will enable the contractor to deliver the finished product—the building. In the architect's office, a group of draftsmen is selected which under a "job captain" begins the preparation of plans, elevations and sections. On these will be indicated such information as materials to be used, dimensions and features of design necessary, first for the bidder to submit an estimate (if competitive bids are going to be asked for), and second for the contractor to build the building. Such drawings are usually made to a scale of $\frac{1}{8}$ or $\frac{1}{4}$ in. and are supplemented by larger scale drawings, as required.

The structural engineer's task is to develop a set of plans indicating the sizes of all columns, beams, girders and trusses. Footings and retaining walls will also be designed and indicated by the same engineer unless the foundations involve problems necessitating an engineer specialist; in the latter event this specialist may be called in either as the designer of the foundation or in an advisory capacity.

The heating, sanitary and electrical engineers will each develop a separate set of plans showing piping, radiation, boilers, pumps, ducts, fans, stacks, fixtures, water tanks, supply pumps, sump pumps, electric circuits, outlets, etc.

As the architectural drawings are developed it becomes necessary to incorporate in them data from the structural and mechanical drawings, such as dimensions of columns, pipe shafts, wire shafts and vent ducts, since these affect basic features of the plans. In turn, the engineers must have information from the architect on which to base their calculations. One would soon be turning in a vicious circle, each party waiting for the other's drawings, unless a clear understanding were had as to methods of trading this information during the different stages of development of the design. Frequent exchange of drawings is one means by which this is accomplished. Visits of the draftsmen to each other's offices and conferences between the architects and the engineers are also resorted to. The facility with which exchange of information is carried out is often increased if the same parties have been associated on previous buildings, so that the system is in some measure standardized.

In order to insure better cooperation in this respect, some architects, principally those in the West and Middle West, prefer to maintain a regular engineering department of their own. Sometimes this will be a structural department, sometimes a mechanical, sometimes both. On the other hand, some architects contend that they secure better talent by employing outside consulting engineers. This latter practice is customary in Eastern cities.

As the drawings proceed, considerable checking will be necessary to insure proper clearance and non-interference of pipes with steel beams, of plumbing pipes with heating pipes, etc. Methods of running structural members, pipes and conduits in connection with concealment by furring and of insuring efficiency for future alterations or extensions will also have to be discussed.

The plans will also have to be checked for compliance with building, zoning, fire prevention, sanitary ordinances; with state labor codes and underwriter's requirements. On important buildings this means preliminary submission of drawings and frequent conferences with the officials of the different departments. Finally, the plans and specifications will have to be filed and the necessary permits secured before the building can be started.

Specifications and Quantity Surveys

All plans must be accompanied by the proper specifications if satisfactory bids and proper execution of the work are to be secured.

The architect's own specification writer or specification department, depending upon the size of the office, prepares specifications relating to all the architectural trades such as masonry, plastering, roofing, painting, glazing, etc. These specifications explain the drawings and state definitely the kind and quality of material and the workmanship required. They are prepared in close cooperation with the drafting room, the job captain, chief draftsman and members of the firm.

It is not customary to issue any estimate of the quantities required. The usual practice is for the estimating departments of the contractor and subcontractors to take their own quantities from the architect's and engineers' drawings. The advisability of issuing a quantity survey with the drawings and specifications has been the subject of considerable discussion in recent years. Obviously, a quantity survey given to all bidders would avoid a duplication of work and expenditure by the estimating department of all the bidders invited. It would also

insure more uniform bidding and would minimize claims for extras. All estimates would be based on exactly the same quantities and the same interpretation of the drawings and specifications. A moot question is: Who is going to pay for the quantity survey? Since the owner, under present methods, gets free estimating service from the bidders, it is hard to convince him that he should pay for this additional service. It has been proposed that the quantity survey be charged pro rata to the different bidders, but many contractors have a preference for their own methods of taking off quantities, claiming that in this way they can better estimate unit prices to apply to these quantities. With these conflicting views, the quantity survey method has not progressed very far.

Contracts and Working Drawings

If the contract is to be let on a lump-sum basis, a full set of plans and specifications is issued to a list of selected bidders, or, for public buildings, to any bidder satisfying certain requirements. If a general contractor has been selected and the job awarded to him on a cost-plus basis, the plans and specifications for the different trades are issued to him. He will then secure bids from different subcontractors, and these bids when tabulated are brought to the office of the architect, either to be accepted or returned for revision.

The building work proceeds according to a predetermined schedule prepared by the contractor. This schedule shows not only the time at which the different trades will start and finish work, but also the time at which the subcontract for each trade will have to be let to insure starting at the proper time. The schedule also fixes the time at which the architect and engineers must furnish their plans and specifications, so that the proper allowance for bidding time can be determined.

Working drawings are the next necessity. Large-scale and full-size detail drawings, scale and full-size models have to be prepared and issued to the different contractors as required. Shop drawings are prepared by these contractors for the use of their own men in the shop or in the field. These shop drawings must also be checked by the architect and by the engineers (where the structural or mechanical trades are involved), to see that they conform with the contract drawings and specifications and to determine that the work of one trade will properly engage with the work of all others.

Records must be kept of the issuance to the contractor of the architect's and engineer's drawings and of their successive revisions. Receipts are kept on file to establish the responsibility in case of future error. Records are also kept of the receipt, approval or disapproval of the shop drawings submitted.

Supervision and Inspection

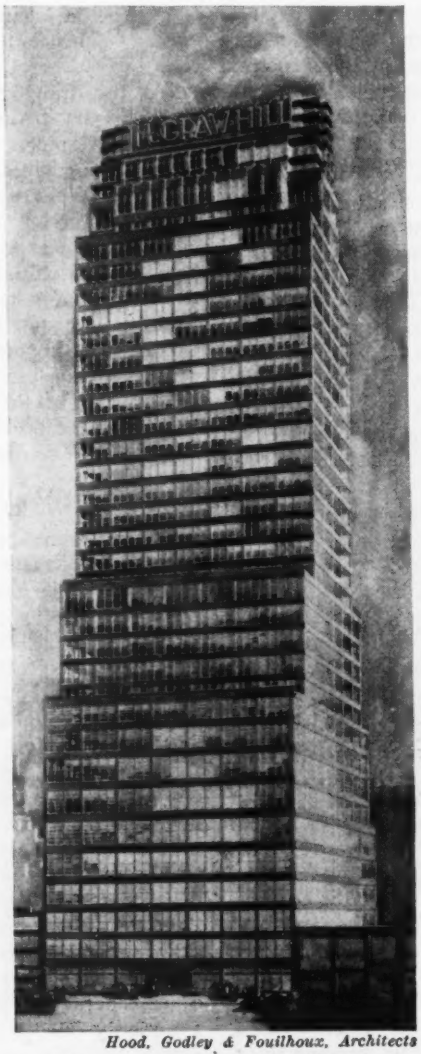
As the work progresses in the field it is subject to supervision by the architects to insure compliance with the plans and specifications. A superintendent employed by the architect may devote all his time, or only part time, to a single job, depending on the importance of the operation. In other cases a "clerk of the work" employed by the owner may perform the same function, depending on the arrangement between the owner and the architect.

The engineers will also have representatives at the building to follow the progress of the piping, conduit, wiring and other equipment or fixture installation. Special firms of testing and inspecting engineers may be employed to test steel at the mills, inspect this steel at the fabricating shops and during erection, and to test cement, reinforcing bars and methods of sampling and grading aggregate.

All reports from the work are received in the architect's office. Any deficiencies or failure to comply with the plans and specifications are reported to the architect, whose duty it is to demand replacement or rectification of defective work. Records have to be kept of changes whether incorporated in the drawings or merely made as field corrections. Orders are issued when changes involve additions to or deductions from contract price, copies being sent to the owner. Architectural records also cover requisitions for payments to be made and balances due.

When the building approaches completion, occupancy permits and underwriter's certificates must be secured and filed with the owner or his building manager. Only after all final inspections have been made, all corrections completed and the building is ready for acceptance, is the final certificate of payment issued.

The building is then turned over to the owner, a finished product, representing the labor of a corps of men—designers, draftsmen, detailers, structural and mechanical engineers, superintendents, etc., all trained in their different lines. The success of the finished building will depend in a great measure on the coordination of all these workers, the cooperation of the builder and his efficient organization, and the willingness of the owner at all times to state clearly his requirements to guide the architect in his decisions.



Hood, Godley & Fouilhoux, Architects

The new McGraw-Hill Building in New York

Walls, Floors, and Partitions in the Tall Building

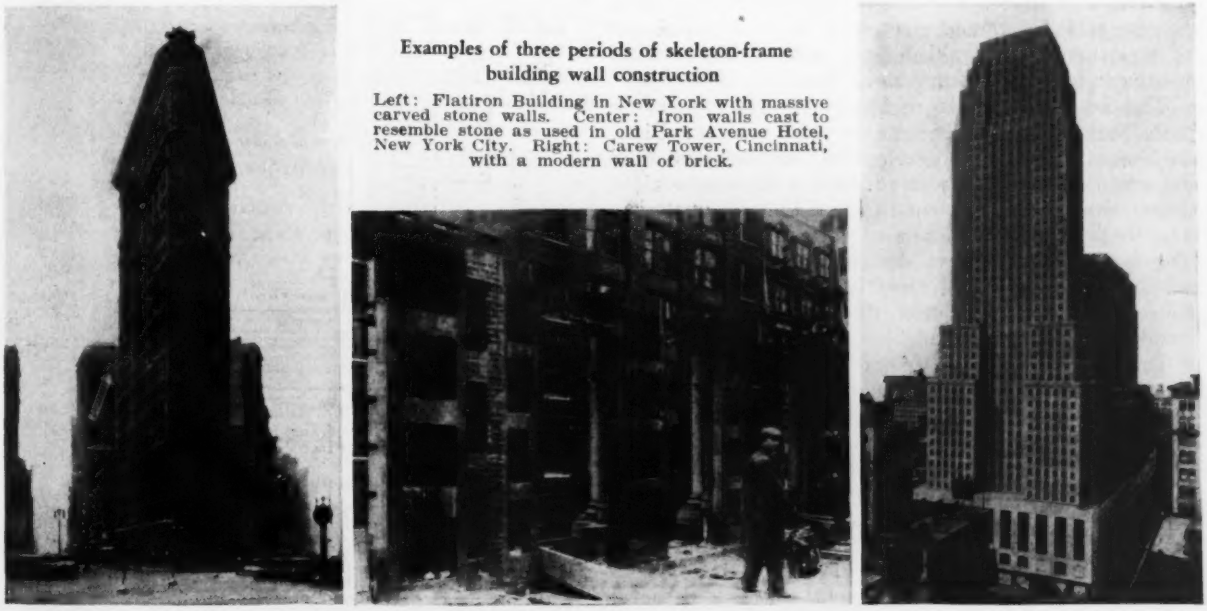
By H. R. DOWSWELL
Shreve, Lamb & Harmon, Architects,
New York, N. Y.

An analysis of trends and developments that may rescue the design of these important building elements from the effects of clinging traditions that are foreign to modern needs and logic

FOR CENTURIES the history of architecture and buildings recorded no really new achievement until the advent of the tall building. Since then the development of tall skeleton-frame structures is a story of difficulties encountered and overcome in nearly all phases of design and construction. The great exceptions to this remarkable advance are walls, floors and partitions. For some unexplainable reason tradition has clung to these important elements, and although changes and improvements have appeared, the heritage of thick masonry walls, heavy permanent partitions and floors, unsuited as depositories for the modern and necessary networks of pipes and conduits, is still apparent. However, the unusual activity in tall building construction of the past few years has focused attention on many of these illogical heirlooms of early architectural and engineering practice so that an analysis of present designs and future requirements is timely.

The construction of buildings higher than six stories was the direct result of the development of the elevator, but a limit to the possible number of stories was soon reached because of the excessive thickness required for the supporting masonry walls. The development of the skeleton frame and improvements in elevator design removed this restriction but strangely enough brought about little change in the inclosing walls. We inherited masonry walls and seem unable to outgrow our inheritance. True, an effort was made years ago to employ cast iron as an exterior covering, but the iron was cast to imitate masonry forms and was backed up with masonry. The idea that masonry is the only form of permanent construction was so deeply rooted that practically all building codes made masonry walls mandatory, and until comparatively recent years these walls in skeleton construction were graduated in thickness from top to bottom notwithstanding the fact that they were entirely supported at each story.

Waterproofing Masonry Walls—Subsequent reductions in wall thickness, together with more rapid and so less thorough construction, brought with them the penalty of leaky walls. Through a strange perversion, architects, builders and manufacturers, instead of directing their efforts toward the discovery of new wall materials, have concentrated on the development of waterproofing and damp-proofing coatings with which to seal leaky masonry. Careful and conscientious workmanship is required to produce watertight masonry walls even when solid masonry units are used throughout. When hollow units are used for backing up the facing even greater care is required. Unfortunately the keenness of competition in the building industry and the speed demanded in



Examples of three periods of skeleton-frame building wall construction

Left: Flatiron Building in New York with massive carved stone walls. Center: Iron walls cast to resemble stone as used in old Park Avenue Hotel, New York City. Right: Carew Tower, Cincinnati, with a modern wall of brick.

execution of the work render it extremely difficult for the most conscientious workman to produce a tight wall. Consequently, the practice has developed of coating the interior face of the walls with waterproof or at least damp-proof compounds, designed to keep any water entering the wall from penetrating beyond the inner face. At the floor levels a waterproof fabric, known as spandrel waterproofing, is applied, designed to collect all infiltrating water and conduct it to the outside face.

Such methods are effective if the proper materials are selected and carefully and conscientiously applied. However, here again speed in erection and price cutting have frequently resulted in the choice of damp-proofing materials and methods which are practically valueless. The application by brush or mop of damp-proof coatings, which must of necessity be thin, has proved to have little real value. A heavy trowel coat of fibrated asphalt mastic or emulsified asphalt, if carefully applied by workmen having a knowledge of the limitations of the materials, will produce satisfactory results. Recently, sprayed-on damp-proofing has received considerable attention, and many satisfactory jobs have been executed.

The selection and application of damp-proofing and waterproofing materials should receive the most careful consideration, for if leaky walls develop after completion of the building there is practically no permanent cure. Efforts have been made to waterproof leaky walls by the application of exterior coatings, and many colorless damp-proofing compounds have been devised. The best of them, however, produce only temporary relief and often cause discoloration.

Logical Wall Designs Foreseen—The absurdity of loading the structural frame of tall buildings with tons of masonry is slowly seeping into our consciousness, and it is significant that the new code for New York City will, in addition to reducing masonry wall thickness to the minimum consistent with stability, leave the way open for other forms of inclosing walls that meet the required standards for fire and weather resistance.

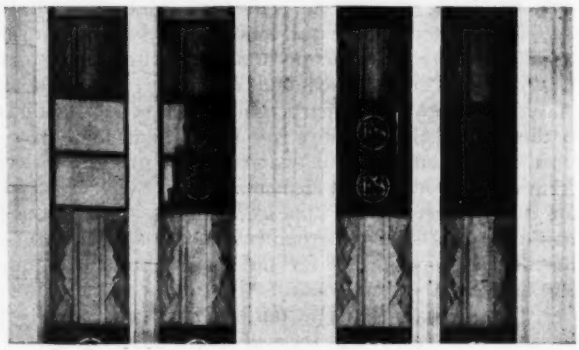
It is difficult to hazard a guess regarding inclosing walls of the future, yet the further development of tall buildings depends upon a satisfactory answer. It is comparatively easy to enumerate the requirements: The walls must be light; they must be weathertight, fire-resisting and have a low heat conductivity; they must be easy to fabricate and erect, must require a minimum of maintenance, and withal be capable of architectural treatment both as to form and color.

The answers to this problem—for there must be more than one—will be found in two sources: First, the manufacturer must develop the materials and then the architect must learn to produce designs natural to these materials rather than to force the new materials into forms which have come to us from our ancestors. The tendency of modern design to break away from traditional forms would seem to indicate that the architect is prepared to meet this problem as soon as suitable materials are available.

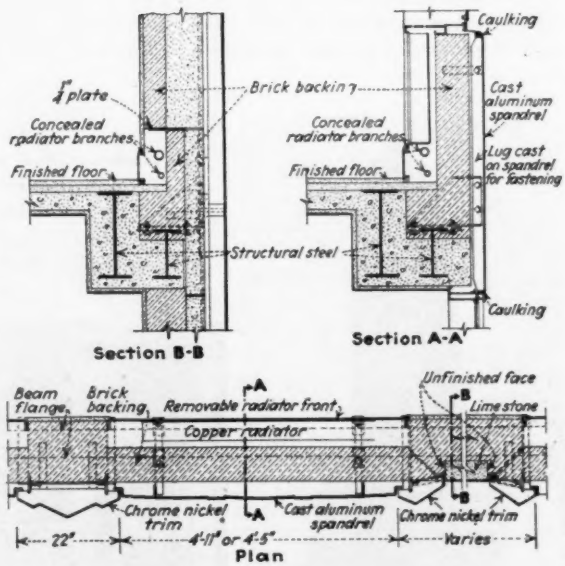
The exterior treatment of the Empire State Building in New York may even be the first major step toward the use of new materials for inclosing walls. The accompanying illustrations of the walls of this new building show how metal windows of a standard type have been joined with cast-aluminum spandrels filling the space between the sill of one window and the head of the window above, and how the two have been framed with polished chrome-steel members, forming a trim which is continuous for the entire height between setbacks. True, the chrome-steel trim and cast-aluminum spandrels are backed with masonry, but it will require but a short step in subsequent buildings to unite the metal window, spandrels and trim, secure the entire assembly to the steel frame and replace the masonry backing with a light non-heat-conducting material.

Cast-iron spandrels as substitutes for masonry are not new. Aluminum spandrels, either cast or of sheet metal, however, are of comparatively recent origin and, being highly resistant to corrosion and susceptible (in the cast product) to architectural treatment in design and texture, have been utilized on numerous important structures, such as the Koppers Building and the Cathedral of Learning, in Pittsburgh, and the Chrysler Building in New York. The Lincoln National Bank Building in Fort Wayne, Ind., utilizes aluminum sheet metal spandrels.

The combination of aluminum, steel and stone used in the Empire State Building is entirely unique. One feature of the construction is that the stonework is simplified, most of it being handled as ashlar. An additional feature of great importance is that the stonework

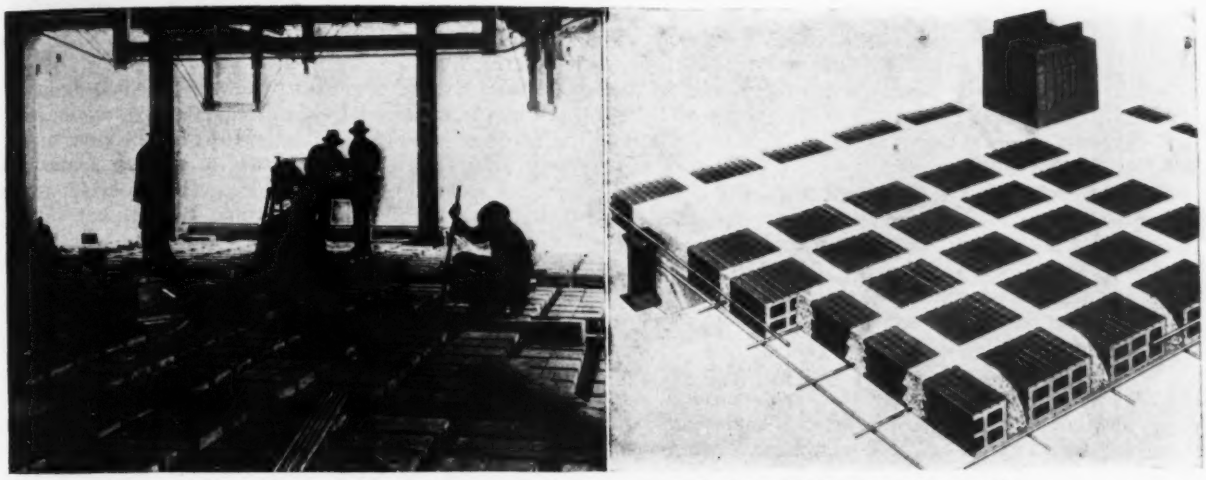


Combining steel, aluminum, glass and stone in Empire State Building wall



Details of Empire State Building walls

A noteworthy feature is the small amount of stone, 1 cu.ft. for each 200 cu.ft. of building volume, as compared with the usual ratio of 1 to 45 or 50. Note also that masonry backing rests directly on spandrel beams, thus eliminating usual shelfs and brackets. A most revolutionary development is that the glass of the upper sash of the double-hung windows is 1½ in. in front of the face of the stone work.



Floor systems with two-way concrete joists between steel girders (hollow-tile filler at right and slag-block filler at left) produce ceiling surfaces unbroken by intermediate beams.

and its backing are designed to be carried directly on the spandrel beams without the shelf angles and brackets which commonly complicate and delay this work. The steel trim is an alloy containing 18 per cent chromium and 8 per cent nickel, of No. 18 gage metal, formed to show 10 in. and 22 in. wide on the face of the building and fabricated in story-high lengths. It is attached by straps to the building steel and calked at its junctions with windows, spandrels and stonework. In general the aluminum spandrels are 4½x5 ft. and weigh approximately 130 lb. The exterior face is sandblasted to produce a dull gray surface. By no means the least important feature of this wall design is the rapidity of erection that it made possible.

The covering of the observation tower which surmounts the Empire State Building will when finished present an exterior in which the traditional masonry has been entirely replaced by a combination of aluminum, chrome-steel and glass, designed and fabricated into forms entirely free from masonry influences. The extension of similar treatment to embrace all of the inclosing walls of a tall building is quite conceivable and, if backed with insulating materials to reduce heat loss and properly finished on the interior, will result in a light wall, readily made weathertight, easy to fabricate and erect and requiring practically no maintenance. When such a step has been taken it is certain that American inventiveness will produce other materials which will accomplish similar results, perhaps more efficiently.

Floors

The construction industry has successively employed floors constructed of brick arches, hollow-tile arches and reinforced-concrete and gypsum slabs. The brick floor arch spanning between structural beams was abandoned very early in favor of the hollow-tile arch, first segmental in form but later replaced by a flat arch. This construction produced a floor much lighter than the brick arch, but open to the objections that unless the soffit of the arch was built flush with the beam soffit fireproofing the intermediate beams projected below the arch soffit; also, in both systems the structural-steel beams had to be reinforced or tied to withstand the arch thrust. Furthermore, the thickness of this construction became excessive unless the floorbeams were closely spaced.

The problem was partly solved in New York City by the adoption of a beam-and-slab system consisting of steel beams with reinforced cinder-concrete arches or slabs, using anthracite cinders both for the arch and for fireproofing. This system produces not only a light but also a relatively thin floor, since a 4-in. slab can be safely used with a beam spacing of 8 ft. Moreover, if the relation of the top of the slab to the steel is well considered, practically all electric conduit and outlet boxes may be placed on the forms and embedded in the arches.

Bituminous cinders have been used to some extent in localities where anthracite cinders are not available, but the difficulty of controlling the sulphur content renders their use open to question. The substitution of a heavier coarse aggregate adds materially to the dead load.

Before the concrete arch came into general use a similar but much lighter construction, using gypsum mixed with wood shavings or similar light aggregate, had a considerable following; but although this system successfully withstood both fire and load tests it never seemed to meet with general favor.

A growing demand for a system which would eliminate intermediate beams that break up ceiling surfaces, and the search for lightness in construction, ease and speediness in installation, minimum thickness and adaptability to the ever-increasing electrical and mechanical requirements, have produced many types of floors. Projecting beams have been eliminated by employing closely spaced reinforced-concrete joints spanning between girders. Of the many variations of this form of construction, the systems employing two-way joists with slag block or hollow-tile fillers offer the thinnest construction and require the least formwork. A flat-slab floor system has also been designed, that compares very closely both in regard to thickness and weight with the two-way joist and filler systems, but its use has been limited to a few buildings and these in widely separated localities. All of these systems, however, when compared with reinforced cinder-concrete slabs, carry the penalties of added weight, slower construction and less flexibility in running conduit.

The floor systems so far discussed have, in addition to their weight, the disadvantage of requiring forms for their erection, the placing and subsequent removal

of which limit the rate at which other trades may proceed. Notwithstanding this objection, however, concrete still offers the most satisfactory method of fireproofing structural-steel beams and girders, and in the slab-and-joist systems provides a ready means of housing electric conduit, a base for floor finish and a soffit which can be readily plastered.

Much effort is now being directed toward the development of lightness in concrete without reduction in strength. A number of materials suitable for concrete aggregate have been discovered which give promise of achieving the desired result, but their adoption for high buildings must await the outcome of tests in less important structures.

The tall building needs a floor system which is light, provides the utmost freedom in placing piping and conduit, permits of shop fabrication and lends itself to speed and ease in erection. Floor systems having some of these characteristics have been devised, such as those employing shallow intermediate steel beams or channels with a precast top slab or steel deck and a precast bottom or ceiling slab.

The precast top and bottom slabs have also been used in conjunction with the bar or trussed joist, and some authorities see in this construction a solution of many problems since the open truss webs permit the running of pipes or conduit in any direction. This type of joist, however, has not been generally accepted for use in connection with the construction of tall buildings.

These systems, while light and largely shop-fabricated, are much thicker than the systems now in use and make no provision within the construction (excepting the bar joist design) for pipes or conduit without a further increase in the thickness.

For example, the depth of intermediate beams or channels as used in this construction for the usual office-building column spacing would be at least 7 in., to which must be added a ceiling slab of 1½-in. minimum thickness and a top slab of 2½-in. thickness, making a total thickness, without fill or finish, of 11 in., compared with 4 in. for the concrete arch or 6 in. for the two-way concrete joist-and-block filler system. Even when steel plates are used in place of a top slab there is still an increase in thickness of more than 4 in., compared with the 4-in. concrete slab. This excess would, in a ten-story building, add sufficient exterior wall for two additional stories, without producing any increase in floor area.

It would seem, therefore, that the building industry has not yet produced a fabricated floor system meeting the needs of the tall building. However, in view of the many efforts being made to devise such a system, it does not seem unreasonable to expect that developments of the near future may overcome the present limitations and that a logical and efficient floor will result.

Partitions

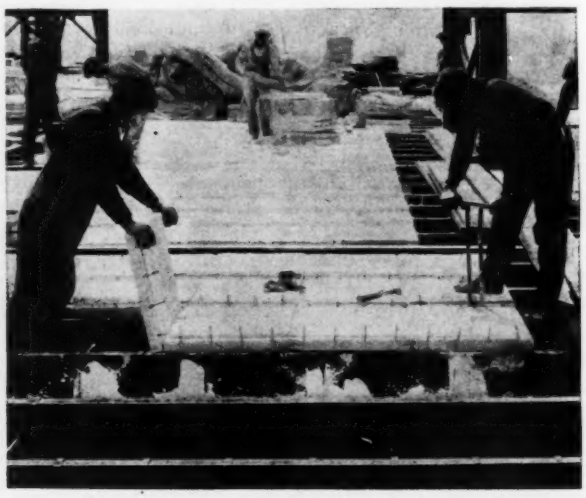
The problem of partitions seems nearer a satisfactory solution. General practice, however, has not reflected this fact. The hollow tile, gypsum blocks, or metal studs and lath now in use all require plaster for a satisfactory finish and once in place, have practically no salvage value when their removal becomes necessary. During recent years, however, unit metal partitions have been produced, which can quickly be set up and readily changed to new locations with practically no loss in material. More recent refinements have resulted in a partition which resists the transmission of sound, has a fire-resisting rating equal to the masonry-plastered partitions commonly used, and provides, moreover, for the utmost flexibility in electric wiring and control.

The Future

It is easy to visualize the tall building of the future with exterior walls of metal backed with insulation, both fire-resisting and non-conducting (as to heat) and partitions of metal, continued as a finish over the interior face of the exterior walls, all shop-fabricated and finished and delivered ready to erect.

It is not difficult to picture what this means. Instead of hauling thousands of tons of stone, brick, tile, mortar and plastering materials through our city streets, transporting them vertically to the various stories, gathering the debris resulting from their handling and again transporting it, we will have entire buildings practically shop-fabricated, to be "assembled" at the site. This vision of shop-fabrication and job assembly is already a fact so far as the other elements of tall buildings are concerned. The problem of the future is confined to floors, walls and partitions.

Steel plates welded to shallow intermediate beams form the floor of A. O. Smith Building at Milwaukee



Light-weight reinforced gypsum slabs have been utilized for roof, ceilings and some floors

Mechanical and Electrical Equipment for the Tall Building

By JOHN A. SUTHERLAND and F. A. BYRNE
Mechanical and Electrical Engineers for Holabird & Root, Architects, Chicago

Excellence of service facilities in the modern building improves rentability, but equipment must occupy a minimum of space—Among problems to be studied on each project are elevator arrangement, necessity for double-deck or dual-car systems, effect of conduits on floor slabs and advisability of zoning electric and heating services

DEMANDS for structures in congested areas or on land that must yield large income, and the modern striving to overtop neighboring buildings or create outstanding structures, are all leading to buildings with towers that appear to have no limit in height. The cost of these structures is extreme and for this reason every possible foot of floor space must be available for rental or for use by the owners.

As in all structures, the problems of the architect and the structural and mechanical engineers are so interwoven that lack of proper coordination of all their problems may result in inefficiency and costly failures. The architect should recognize that in these buildings he must take extra precautions to protect against heat, cold, snow, rain and noise, and that mechanical means within the building to protect against these elements of nature must be given floor space. He must provide access to all utilities throughout the building and arrange for these utilities to be placed so as to yield as high efficiencies as proper and modern design will allow. And further, he must consider carefully the problem of concealing them and yet permitting reasonable access for inspection, alteration or repair. The structural engineer, in his problems of providing thin floor framing, must allow for conduits and duct runs and must adjust framing wherever possible to permit the many horizontal runs of ducts and pipes required. He must give consideration also to the prevention of sound or other vibrations being easily transmitted or magnified within the building. The mechanical engineer must avoid loading upper portions of the building unnecessarily and must take the least space commensurate with the satisfactory and efficient operation of the various types of equipment he installs.

Slender structures such as the Mather Tower in Chicago create special problems of elevator arrangement and service facilities

The design and arrangement of all the mechanical and electrical equipment is governed, as in all buildings, by the amount of space to be served and the limited space available. But when a building gets beyond certain limits in height this element of height affects materially the type and arrangements of elevators, of heat-distributing pipes, water and drainage systems, fire-protection service and the locations and subdivisions of conduit systems.

The type and arrangement of elevator systems is a vexing problem, since the solution is based upon an assumed traffic requirement that must start with an assumption of what the occupancy of the building may be in number, arrangement and vocation. There is the further assumption that the traffic load will be proportionately the same as in older but similar buildings.

A few years ago no building of prominence was built without at least one spare elevator even on peak loads. Today this might mean three or more spare elevators, if one is to be placed in each bank on a high building. In order to provide rapid, safe and efficient vertical transportation in high buildings, all unnecessary travel and stopping of the cars must be prevented. To do this means dividing traffic into zones. The number of floors served by elevators in one zone, where more than two elevators are required in a zone, should not exceed sixteen for cars lifting less than 3,000 lb.

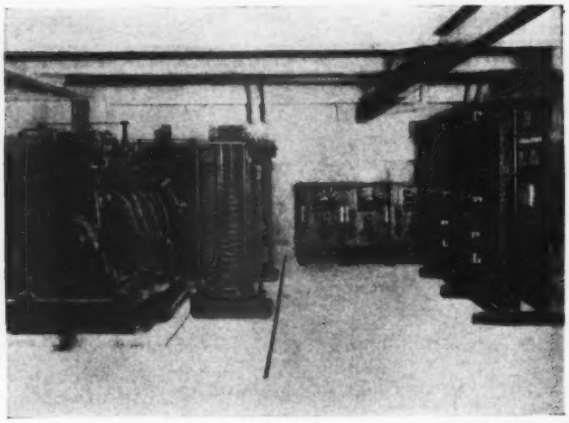
In the elevator equipment it is essential that advantage be taken of every facility for speedy handling of the traffic without inconvenience to the passengers. This applies not only to the movement of the cars but to the operation of the doors and the proper signaling to passengers. Full automatic control of all the operations

of elevators and the accessories such as doors, signals, stops and reversals is absolutely essential for the requirements of tower buildings. All stops must be made positive, in answer to signals from passengers, with no reversals. The time consumed in slow-downs, stops and opening and closing of doors must be reduced to a minimum and should not exceed slightly over five seconds for a trip from floor to floor, including the opening and closing of doors.

Twin or Duplex Elevators

Any scheme which provides for two cars in a hatch or double platforms on one car, for the purpose of economizing space, must sacrifice some other more desirable features either of safety or maintenance cost. It is believed that the disadvantages would in the majority of cases outweigh the advantages.

Some recent buildings have been constructed with the



Elevator machinery and controls
Note ventilators in walls of room and special cushioned mounting for the motors.

idea of using two-level cars or platforms in a single hatch. (According to report, eight of the hatches in the new 66-story Cities Service Building in New York are to be equipped with such cars—EDITOR.) These two-level elevators are arranged so that the upper and lower platforms will land simultaneously level with adjoining floors. With certain conditions of use this reduces the number of stops on a round trip of the car to such an extent that it is claimed the two-level platforms may have a carrying capacity 35 to 60 per cent greater than has been possible with a single-platform elevator. This increase in capacity is possible with a cost for the machine and control that is little more than that for a single elevator, while the space requirements through a tower building would naturally be saved.

These arrangements of double platforms for vertical transportation are an unusual development for use in an unusual type of building. As far as vertical transportation goes they do not increase either comfort or safety to the passengers, while the question of saving time depends greatly on operating conditions.

Some of the disadvantages of the two-level platform are a necessity for two different loading levels at the main floor, preferably arranged so that odd floors are served from one level and even floors from another level. This requires ramps or escalators up or down from the main loading level, or ramps or stairs arranged for passengers to reach the elevators at the proper level to take the cars serving their floors.

There is no saving in labor costs for operating the two platform elevators, as two operators must be provided in any first-class building. This labor cost serves to offset savings made in electric current and in first cost of the equipment. Any excessive interfloor traffic within the building would complicate the operation of a two-landing platform when tenants on an odd-numbered floor desired to travel to an even-numbered floor or vice versa, owing to the necessity for stops at what might be called a half station. To obviate this, it would be necessary to require passengers to walk one floor.

In the event that crowded conditions of occupancy should exist on one or more floors, it might develop that a two-platform elevator would be operated at times with one platform running empty, unless special loading conditions were arranged for peak traffic at the first-floor level. Any interruption to service on a single machine handling two platforms creates greater impairment of service than where one elevator only is out of service.

The dual system has also been considered, but it would seem that the operation of two separate elevators serving different zones, but using one hatch, might introduce a multiplicity of transfer floors, separate loading levels, excessive cable wear and more intricate interlocking for safety in operation than such an arrangement would warrant in savings. (An elevator system with an express and a local car operating in the same shaft independently, but protected automatically from interference, has been installed recently in an office building of the Westinghouse Electric & Manufacturing Co., at East Pittsburgh, Pa., and is reported to be operating satisfactorily. The express car runs from the first floor half way without stopping and then serves the upper floors, while the local car serves only the lower floors—EDITOR.)

The location and arrangement of the machinery for express and local, or zoned, service for tower buildings requires no special framing, except that made necessary by space restrictions. Heights and clearances for overtravel of cars must be maintained and supporting beams provided as in any installation. The heights, however, and the spaces for secondary sheaves and auxiliary equipment must usually be maintained to suit the heights established for adjoining floors, where the machines are located in the central portions of the building.

With machines located within the building it is essential that proper ventilation be provided either by flues or fans to carry off the heat generated by the equipment. This is also necessary in penthouses, but more especially where the machines are inclosed, without outside windows, in the central spaces. Moderately high-speed rotary equipment used for high-speed elevator control requires cushioning of foundations, and while the modern control is free from the noise that existed in the old type of control boards, it is policy to insulate the rooms housing all elevator equipment.

Boilers and Heating Equipment

It is not the purpose here to go into any of the details of design or selection of the power and heating equipment, except as excessive heights of the building may affect the arrangement of the various systems which serve the occupants. The boiler equipment is governed only by the actual load requirement and not by height. But the space limitations are still present, and for this reason, as well as for questions of operating

costs, as much automatic operation as possible is advisable. Thus coal or other fuel should be handled by gravity from the receiving point in the building to the combustion space in the boilers, or automatic stoking or feeding should be installed. The heating systems must be developed into zones, divided both horizontally and vertically, to permit ease and economy in control of the steam-distributing lines. This allows savings to be made through variations in the heat requirements on exposed sides of the building and other special locations.

High-Voltage Electric Service

The constant increase in the size of individual structures has proceeded to a stage where the resultant electrical loads and distances traversed have far outgrown the field of the heretofore almost universal 230-volt distribution system, so far as the main feeder systems in commercial buildings are concerned. While voltages of this order, particularly in the Edison three-wire system, have proved entirely satisfactory so far as operation and reliability are concerned, it is evident that higher voltages must be resorted to for economy.

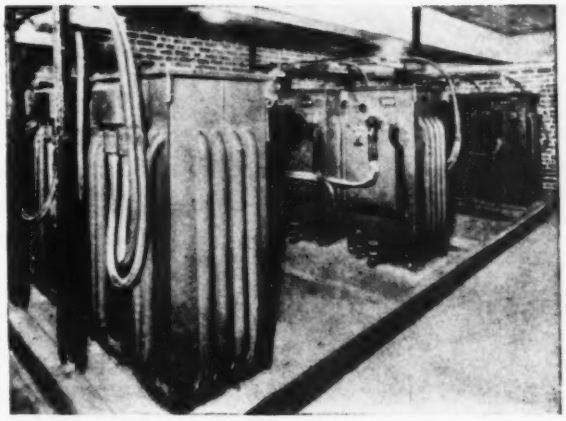
The use of high voltages naturally dictates the use of alternating current, which, instead of being considered undesirable as formerly, is now to be preferred due to its readily transformable character and especially to the fact that present-day power developments are practically confined to the alternating-current field. Direct current in some cases presents distinct disadvantages when considered from certain angles, principally as it prevents the use of standard radio devices, synchronous time-indicating devices and probably daylight radiating lamps, unless auxiliary converting equipment is utilized.

The use of alternating current for commercial building supply in the business districts of the larger cities has been retarded by the complications of intermingling its use with the older established direct-current systems. Fortunately the dictates of economic necessity are overcoming such difficulties, and in certain large recent structures the 13,200-volt primary system has been utilized for interior vertical distribution.

The use of such high-tension distribution eliminates the concentration of switching equipment in the basement or sub-basements, and distributes step-down transformer stations at various intermediate floors, thus sectionalizing the building electrically and restricting the secondary low-voltage distributing areas to moderate limits, generally considered at fifteen to twenty floors. The 120/208 secondary feeders should preferably be looped between adjoining transformer stations and duplicate high-tension feeders be provided with transfer and cutout switching devices, in order to provide assurance against interruption of service.

The necessity for space conservation encountered in modern commercial buildings requires that extra precautions be taken in interior high-voltage construction. All compartments or inclosures housing such equipment must embody maximum fireproof qualities and provision for easy accessibility, since high-tension equipment is, by its very nature, more susceptible to failure than the low-voltage equipment. Facilities for proper ventilation of vaults and for the removal and replacement of transformers must be provided.

Particular attention must be given to the selection of the type of cable to be used for high-tension vertical feeders and to the means provided for its support. Experience to date indicates that varnished cambric insulation, as heretofore used in high-tension work, is unsuitable for conductors installed vertically, due to the difficulty encountered in preventing the loss of the impregnating compounds at splices and terminals. For this reason, rubber-insulated conductors are generally used.



Transformers on 13,800-volt system, Chrysler Building, N. Y.
The vault shown, with three banks of transformers, is one of four located on the 1st, 30th, 60th and 74th floors. Main feeder conduits on the circuit are 3½ in. in diameter.

The problems of horizontal distribution are not usually affected by building heights, except perhaps in the matter of control and metering of power and light for building operation use.

Conduit runs for the electric service are often a problem in many types of floor construction, and where pan or joist or similar construction is used the minimum thickness should be 3 in. for the top slab. With some of the patented types of tile and joist floors a 2-in. fill is sufficient for limited conduit requirements if special care is used in placing conduits to minimize conduit crossings. With tile arch and joists, the fill should be 2½ in., and with steel framing and tile arches it must be 3½ in. With underfloor ducts, which provide a flexible method of providing wiring facilities for lights, telephones, etc., at almost any point on the floor, all these thicknesses must be increased to 5 in. on pan and joist types, but on tile-arch floors 4½ in. will be sufficient. The above thicknesses are based upon the use of ¾-in. conduit.

The character of intended occupancy of a building will in some measure indicate in advance the amount of conduit which must be accommodated in a floor slab; and, in general, it will be found that any attempt to place conduits in slabs less than 2½ in. in thickness will operate to increase the first cost and subsequent maintenance of the electrical installation. In many cases the increased cost of electrical work due to restricted slab thicknesses is justified by reason of the greater savings resulting in the structural work. However, the relative costs must be studied in all cases to insure the most economical plant.

Finally, it may be added that for all better-class buildings, both large and of moderate size, to maintain their position as modern as long as possible among later constructed buildings, it is imperative that they should be fully equipped in accordance with the tendency of the times for the ever-increasing use of electric current. This requires the provision of liberal spare capacity for future additional loads, which develop rapidly in the use of new devices that tenants or owners find convenient, both in offices and homes.

Making Buildings From Blueprints

Erecting a modern skyscraper is a high-pressure job requiring experience, organizing ability, leadership and financial resources, as witness the construction of the latest of the super-tall buildings on which 2½ million dollars worth of work was completed monthly for four successive months

By W. A. STARRETT
Starrett Brothers & Eken, Inc., Contractors, New York City

MEASURED in either rapidity or magnitude of its works, building construction has within barely a dozen years recorded achievements so great that it may fairly be said to have created a new human art. Let us ask what are the essential tools and methods of this art. First, an introductory word of explanation is necessary as to the true function of the builder.

Broadly, the organization which brings into being a modern skyscraper can trace its descent directly from the builders of all ages, even from Solomon and Hiram. But the new school of building, ushered in by the daring of a clear-thinking group of engineers, architects and builders in Chicago 40 years ago, gave a new impetus to the energy of the craft. As their work led to ever bolder undertakings, not only did designers change but also the contractor evolved from the grade of handicraft specialist to the position of coordinator and manager.

Inclosure follows steel erection closely
Empire State Building, New York

Today craftsmanship is but one of the instrumentalities in the creation of the towering structures of our great American cities. The engineer-manager is in complete control, directing the manifold activities of the building business to the aid of craftsmanship. Yet he is but one of a cooperating group of three: *The builder is in an inseparable partnership with the architect and the owner.*

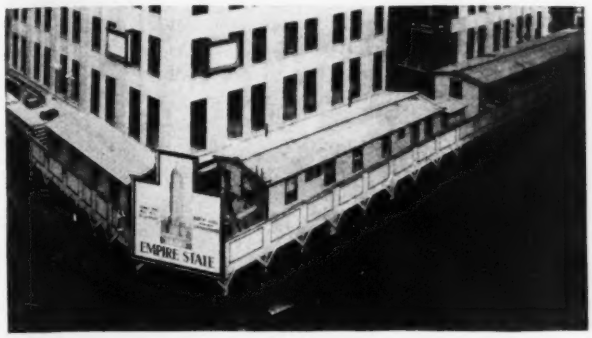
Whether the builder takes work on a low bid or whether he operates on a cost-saving and profit-sharing basis with the owner, he must live with and work with the two other parties to the enterprise. *The three must jointly build and finish the structure without regard to their separate, individual interests.* This, incidentally, is the expression of the best contract relationship as it perhaps always existed; but it acquires a new force and status in the skyscraper construction of today.

Excepting in government or public work, where the ancient fetish still prevails that the contractor is a vender of the thing that the architect has planned, and where years of delay seemingly mean nothing, the necessity of the swift return to earning of the property under improvement has quickened the organization of building until private commercial work, which particularly means the skyscraper, is universally considered in terms of time as well as of money. The terms are really synonymous, and the watchword of the builder is organized forethought.

First of the elements of the builder's planning necessarily is precise and full knowledge of the required work. Thorough skill in devising the most efficient methods for carrying the work out is a natural concomitant; this we will take for granted, as also the completion of the architect's and engineer's plans defining the work to be done.

Since it is the problem of the builder to bring the project to successful conclusion, the responsibility for the time element falls almost wholly on him. On questions of design and arrangement and largely of materials the builder defers to the architect, but in matters of ways and means the architect must lean on the builder.

Information, then, is the keynote of building planning, and no structure can possibly be built without its being complete in full degree. The owner supplies information when a cardinal decision is necessary. From the architect comes a wealth of information. The civil and mechanical engineers have a vast amount to contribute in interpreting the architect's requirements and designs. Then there is the information to be obtained from those agencies not directly covered by engineering, such as firms providing windowframes, marble work, sheet metal and roofing, stairways and ornamental finish of all kinds. Approval of the shop drawings made by these remote and wideley scattered agencies furnishing



General contractor's offices on sidewalk bridge

all manner of things to the building, as well as the production and shipment of the materials in accordance with carefully prepared time schedules, are solely the builder's responsibility.

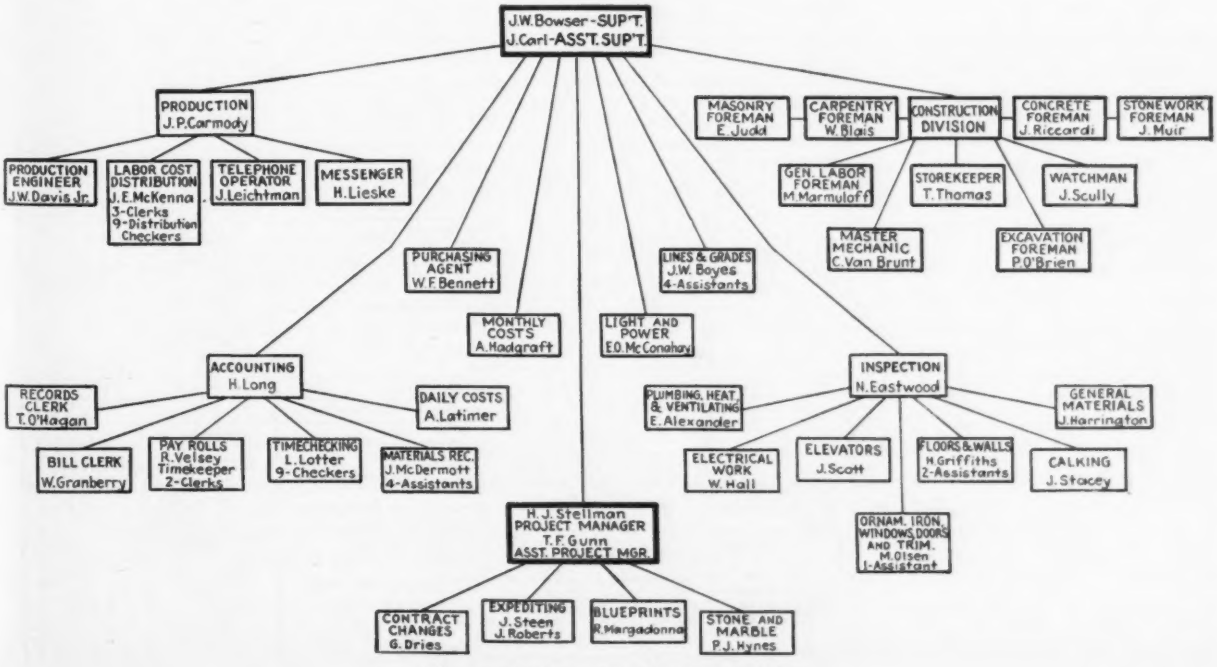
It has been truly said that these great structures are not built from the architect's drawings at all but almost wholly from the shop drawings of the makers of all sorts and diversities of things that go to make up the modern skyscraper. In this light the architect's drawings, although completely essential, are nevertheless only the guides and indications of what the building is to be. This tendency to build from shop drawings has grown from small beginnings when craftsmanship dominated to the present day, when business management has developed the skyscraper almost into an "assembly" proposition.

The organization to meet these conditions must of necessity be well trained and coordinated. Mere consideration of the work under way at a building site can give no adequate idea of the organization back of the activity seen there. To comprehend this organization we must examine it from its source, gaining an appreciation of the years of experience and the value of teamwork on the part of men who, through intimate contact with the development of the science of building, know the problems that will arise as well as the methods of solving them. Although the organization must be complete with its administrative, accounting and financial departments, the interest here lies in the operating department through whose vigilance and effort the modern swift accomplishment of skyscraper construction is brought about.

Perhaps the best way to visualize the work of the operating department is to describe its work in connection with a modern tall building—for example, the 85-story Empire State Building in New York City on the site of the old Waldorf-Astoria Hotel.

When it is remembered that the first upright piece of steel in this building was set on April 7, 1930, and that on Dec. 1, 1930, the steel had been completely topped out 1,250 ft. above the street and the derricks removed; that the limestone exterior 85 stories high had been completely finished on the same date, with the vast train of interior finish of plumbing, heating, ventilating, electrical work, marble tiling, plastering, elevators, window-frames, glazing and a myraid of other incidental but essential things moving in such close sequence that it is now apparent that the building will be finished long before May 1, 1931, the magnitude of the accomplishment is apparent. Figures are tiresome, but the one of 58,000 tons of steel will appeal to engineers. And another one: for four successive months, over 2½ million dollars worth of work was accomplished each month. The building occupies over 85,000 sq.ft., contains approximately 36,000,000 cu.ft. and offers over 2,000,000 sq.ft. of net rentable area.

Organizations that carry out work of this character do not just happen. The directing heads of Starrett Brothers & Eken, Inc., which was intrusted with the complete problem of demolishing the old hotel and erecting the new building, had had from 20 to 40 years of skyscraper-building experience, with perhaps a billion dollars worth of structures to their credit. To Andrew



Job organization on Empire State Building

J. Eken, who from the inception of the company has been in charge of its operating department, largely belongs the individual credit for the phenomenal construction record made in the erection of the Empire State Building. The operating manager of a modern building organization must have unusual qualities and qualifications. Long years of experience is a most necessary qualification. In addition, he must be a born organizer with a genius for long vision and a nose for those things far ahead which may obstruct his plans. He must leave nothing to chance and must be keenly analytic in his study of the elements that go to make up the composite of building activities. In addition to meeting all of these requirements, Mr. Eken has developed an operating system that has made possible some of the greatest speed records in the field of building construction. Such systematizing and planning includes the training of competent superintendents, estimators, liaison men so inadequately termed "job runners," expediters and specialists in analysis of mechanical work of all sorts. Then, too, there must be a vast amount of inspection, for misfit things cannot be allowed to arrive at the site. On the firing line everything must function exactly as planned. Naturally it does not always do so, and in spite of all the organized forethought that can be brought to bear, accidents will happen. It is no inconsequential part of the training of the operating men that they must learn to meet these emergencies and occasionally to sustain temporary defeat.

Control Activities

The activity of the operating organization starts the moment the contract is signed. The first work is to bring the operation under budgetary control. From the information at hand, whether it be preliminary sketches or finished plans and specifications, a budget in the form of a "summary sheet" is developed as quickly as possible. Specifications, memoranda or stipulations are read and compared with the available sketches or drawings. Omissions or special constructions are noted, quantity surveys on items susceptible of such examination are started, and the whole machinery of ascertaining the probable cost is set in motion. At the same time the site is examined and soil conditions studied to determine if there are to be variations in the foundation design, or indeed, if the most suitable form of foundation has been designed. Frequently it happens that the owner's and engineer's assumptions as to foundation conditions are not borne out, and an immediate revision must be considered. Demolition of the existing buildings on the site must also be immediately begun, for under modern conditions this is a major part of the builder's problem. It was particularly so in the case of the old Waldorf-Astoria, for its framework of steel and masonry was of comparatively modern design and especially resistant to demolition tools.

With the budget or preliminary estimate under way, the time schedule is considered, and with it the question of steel delivery, as all time schedules revolve around the dates of first delivery and final completion of the steel.

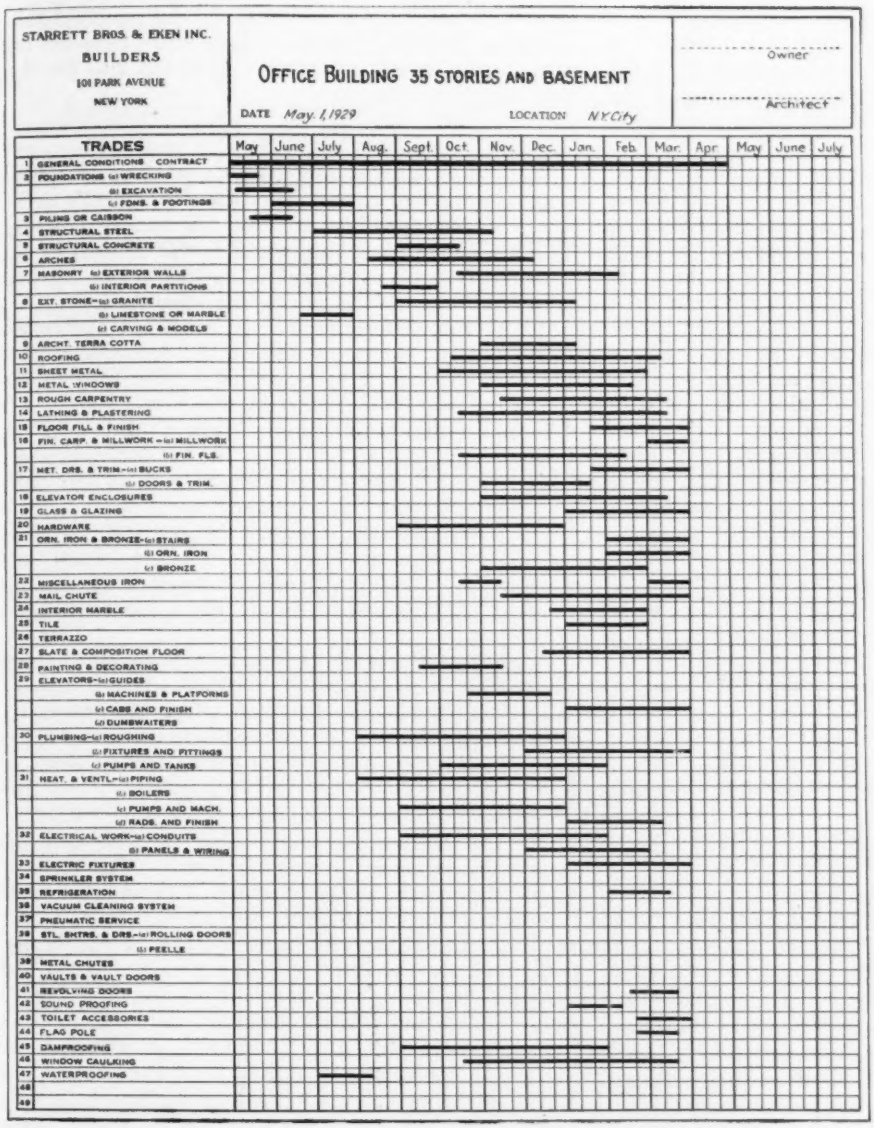
For a month or two immediately succeeding the sign-

GENERAL SUMMARY OF ESTIMATE

SIZE 200'x150' FLOOR AREA 298,000 Sq. Ft. STORIES 35, Basement and Pent House CUBE 3,572,000 Cu. Ft.

			Cost	Cost per Cu. Ft.
1	General Conditions	Permits, Organ., Ins., Bonds, Office Heat & Light, Fees, Plans 5%	118000	033
2	Foundations	Wreck., Exc., Shors., Sheet. Pile & Walls, Underp., Waterpl., Pumps	150000	042
3	Piling or Caisson	Pile, Wood, Concrete, Cut-off; Caisson, Open, Air	39000	011
4	Structural Steel	Details, Inspect., Setting, Paint., Stack, Stack Lin., Bases, Lintels	285000	082
5	Structural Concrete	Forms—Steel, Concrete, Test, Patching, Stack, Plant	10600	003
6	Arches	Tile, Cinder, Stone; Mesh, Clips; Column and Beam Fp.	96000	027
7	Masonry	Scaff., Com., Face, Court, Fire Brick, Tile Part., Gyp. Part., Col. Cov.	280000	078
8	Exterior Stone	Lime, Sand, Marble, Granite, Artif., Haul, Set, Carv., Arch., Model	79000	022
9	~~Artificial Terra Cotta~~	Carriage, Setting, Anchors, Scaff., Mortar, Hoist, Models	21300	006
10	Roofing	Composition, Gravel or Slag, Slate, Tile, Tin, Copper, Lead; Memb. W. P.	8000	002
11	Sheet Metal	Flashg., Sky-lights, Screens, Glazing, Gutters, Leaders, Vent., Leader Boxes	17000	005
12	Metal Windows	Steel, Bronze, Hol. Met., Frms. & Sash, Hdwe., Sct., W. C. Bolts, Store Fts.	39300	011
13	Rough Carpentry	Ground Back, Sleeper, Rgh. Floor Sheathing Framing	80002	002
14	Lathing & Plastering	Furring, Cor. Bds., Metal Gds., Stucco, Solid Part., Susp. Ceil.	125000	035
15	Floor Fill & Finish	Fills; Cont. Fl., Strs., Base, Sills, Cop.; Hdnr., Mast., Brk., Pav.	54000	015
16	Fin. Carp. & Millwk.	Doors, Wdw. Sash, Frames, Trim, Dresser, Mantel, Stairs, Fin. Fls.	79000	022
17	Metal Door & Trim	Hol. Met., Kal.; Doors, Jamb & Trim; Int. Part., Bor. Lts., Toilet Part.	132000	037
18	Elevator Enclosures	Doors, Buck, Jamb, Trim, Sill, Fascia, Hanger, Dust Cover.		
19	Glass and Glazing	Int. & Ext., Windows & Doors, Store Fts., Mirror, Ceil. Lts., Bank Screen	25000	007
20	Hardware	Int. & Ext., Window & Doors, Dresser, Closet Figs., Bead Screens	21500	006
21	Orn. Iron & Bronze	Stairs, Railgs., Fire Escapes, Hangers, Doors, Orn. Frames, Sills, Awn. Dev.	35700	01
22	Miscellaneous Iron	Whl. Gds., Curb Agls., Bcks., Flag-pls., Safy. Trds., Gtgs., Ldrs., Wire Wk.	21200	006
23	Mail Chute	Floor Thimbles, Backboard, Box, Angles	7100	002
24	Interior Marble	Marble, White Glass, Scagliola, Art. Stone, Toilet Part.; Models	64000	018
25	Tile	Ceramic, Encaustic, Mosaic, Special, Gustavino, Rubber, Cork & Mats	28600	008
26	Terrazzo	Plain, Colored, Brass Strips, Base	21400	006
27	Slate & Compost. Flr.	Slate Stair, Toilet Work, Composite, Non-Slip, Linoleum		
28	Paintg. & Decoratg.	Prime, Bk. Pig.; Wood, Metal, Plaster, Pig.; Finish Wood Firs.; Mech. Pig.	43000	012
29	Elevator & Dumbwt.	Excl., Sidewalk & Ash Lifts, Dumbwrs., Signals, Cabs, Cloors, Interlks.	2220000	062 2
30	Plumbing	Gas, Fixtures, Filters, Tanks, Ejectors, Pumps, Meters, Fire Hose	132000	037
31	Htg. & Ventilation	Boilers, Temp. Regul., Pipe Cov., Air Washer, Fans, Ducts, H. P. Piping	1110000	031 2
32	Electrical Work	Telep., Teleautogh., Car. Cl., Clk. Sys., Bglr., Fire & Wich. Alm., Dyn. & Gen.	1680000	047
33	Electric Fixtures	Gas, Electric, Combinations, Signs, Lamps, Glassware	178000	005
34	Sprinkler System	Tank, Supply Pipe, Pumps, Sprinkler Heads, Auto Alarm, Dry Alarm		
35	Refrigeration	Machines, Pumps, Tanks, Insulation, Refrigerators & Doors, Ice Wtr. Rig	71000	002
36	Vacuum Cleang. Sys.	Piping, Power, Receiver, Sweepers, Fittings		
37	Pneumatic Service	Pneumatic Tubes, Compressed Air System, Stations, Fittings		
38	Steel Shutters&Doors	Stl. Roll. Drs., Sldg. Drs., Fld. Drs., Shutters, Peele Drs., Auto Hdwe.		
39	Metal Chutes	Package, Garbage, Linen, Dust, Conveyors, Spiral		
40	Vaults & Vlt. Doors	Vault Linings, Fittings, Doors, Safes, Vault Walls, Fls. & Reinf.		
41	Revolving Doors	Wood, Metal; Kick Plate, Panic Hdwe., Glazing, Ceiling, Frame	42000	001 2
42	~~Toilet Partitions~~	Vault, Sidewalk, Roof, Floor	71000	002
43	~~Chimneys~~	Radial Brick, Concrete; Foundation, Lining, Lightning Rods, Ladders	43000	001 2
44	~~Furniture & Fittings~~	Awning, Shade, Screens, Carpet, Kitch., Hosp. & Lndry Fixt., Incin.	4000	000 1
45	Dampproofing	Ext. Walls; Int. Walls; Spandrels	107000	003
46	~~Window Caulking~~	Windows, Doors, Store Fronts	22000	006
47	~~Miscellaneous~~	Windows, Doors, Show Windows	45000	001 3
48			2500000 #	7000

The summary sheet or budget is a basic document



The progress schedule is a companion piece to the summary sheet

Laid out as shown above at the beginning of a job, this schedule charts the time for every operation. As work proceeds, some suitable symbol such as a cross or circle is drawn over the black lines to indicate progress.

ing of a contract, the operating branch of the builder's office teems with the activity of order placing and the securing of information to get the parts of the building into production. Actual and final information is the necessity. It is not enough to determine column centers and girder layouts, because at this stage we are dealing with what the man at the bench needs and not in estimates and probabilities.

Steel is not the only thing to be determined upon and ordered. Plumbing, heating, ventilating, electrical work, elevators, refrigeration, air conditioning must all be bought. Then there is the selection of marble work, which is the task of the architect, since here artistic effects are involved. But selection of all of these things only begins the problem. After design come methods of constructing and anchoring—decisions which must be made from the shop drawings of the subcontractors, with the approval of the architect. During all of this work every activity must be carried on in strict accordance with the time schedule.

But even before the orders are placed an important preliminary is necessary. The directing head of the operating department must have accurate knowledge of the standing and ability of the subcontractors he intends to invite on a given operation. Much will be lost by placing orders for any part of the building in a shop that will be overcrowded at the time the desired material has to be brought through. It is also out of the question to place a highly specialized piece of construction in the hands of a shop that has not the capacity nor the experience to carry it out. The problem is one of everlasting vigilance, for a single cardinal item in default may cause the collapse of a whole time schedule.

Job Organization

Job administration — in other words, a capable job superintendent — is all-important. Essentially, he must be an executive with a keen ability for leadership, a talent for coordination and an eye that constantly scans the cost sheets. The job superintendent deals with subcontractors and with his own forces through his chosen foremen. Under the system Mr. Eken has developed, the superintendent is not concerned, theoretically at least, with the procuring of information from the architect, owner or subcontractors regarding items to be made away from the job. It is the job superintendent's right to expect that all the various and sundry things prepared for the work will be forthcoming on the appointed day and hour. His responsibility for them commences only when they cross the curb line at the site.

As a matter of fact, the superintendent is in constant touch with the job runners and the expediters. He confers with foremen of the various trades, commands the sequences of work, directs the adjustment of delivery schedules and places special effort at certain points to keep operations flowing smoothly. In brief, he is the commander-in-chief on the site.

There is an accounting end of the business that again, theoretically speaking, does not come under the direct supervision of the job superintendent. All timekeeping and material receipting are controlled from the office of the treasurer of the company. Here a special supervisor under strict discipline watches all payroll and material expenditures. The same timekeepers record the segregation of payrolls and supplies, for cost records are

dependent upon the accuracy of that work, even if strict accountability is not essential. Again, as a matter of fact, the job superintendent is cognizant of the detail of this work, and no timekeeper or checker would be allowed to stay on the work an hour if the superintendent disapproved of him.

The picture, therefore, is of a far-flung organization, first budgeting, then dissecting, and finally coordinating and assembling the elements of a skyscraper-building operation. In Bedford, Ind., expediters are checking quarry blocks onto cars destined for cutting sheds far from the quarries. The job runners have seen to it that the schedules of quarry sizes are in their hands. Inspectors are checking off finished work in the cutting sheds, where a special time schedule requiring so many finished products per day is the guide followed. In foundries and metal shops, elevator openings and frames are being cast and finished, and bronze work of all sorts is being assembled. The job runner not only had to get the shop drawings approved, but modeling was needed, and somewhere a sculptor of the architect's choosing had been time-scheduled and hurried to produce models on time, while the architect had to be notified to get to the studio and approve the models. In Chicago an expediter was laboring with the manufacturer of a new type of radiator needed on an early schedule to furnish temporary heat. Optimistic claims of quantity-production ability had here collided with lack of shop organization, and the builder's agent was on hand to compel performance on an agreement to deliver. A job organization is efficient only when it functions smoothly under all manner of difficulties.

Old Organizations Obsolete

In the early days of skyscraper construction the organization to carry out a building contract generally consisted of a superintendent, a timekeeper and a material clerk. Books and ledgers, such as they were, were kept in the main office of the contractor. These three men, with the appropriate number of skilled trade and labor foremen, carried the job through to completion under the personal supervision of the master builder. Later the refinement of an assistant timekeeper and perhaps of one or two extra checkers was included in the organization.

The building superintendent is still in supreme control, but now we have one, two or three assistant superintendents, with the work broken down into masonry, mechanical trades, and perhaps other highly specialized functions of superintendence. Timekeepers under the direction of a head timekeeper are employed in numbers. It has been found that the limit of accurate supervision for a single timekeeper or checker is about 150 men.

In like manner the material receipts have to be ordered under a head material accountant with his organization of inspectors and checkers. Then there is accountancy, which is now a job function because the owner's representative on the job must have information available at all times, so that emergency decisions may be measured in the money value involved. Also, there is the question of tenant changes and to a lesser degree constructional changes of all sorts on large operations. These changes seem to be inevitable in spite of the ever-shortening construction period required for our modern buildings. On our jobs a supervisor who has charge solely of changing orders is an important part of the organization. He is under the direction of the superintendent but accountable also to the operation manager. His decisions must also receive the approval of the architect and owner, and he must make out change order estimates not only for the general contractor's work but also for that of all the subcontractors.

The Business Side

There is a financial aspect to all building operations quite as exacting as the operating department's activities. Modern buildings are paid for as they progress, generally month by month, and it is the business of the operating department to inform the treasury on the first day of each month concerning the month's accomplishments, so that statements may be made out and collections taken in. Contracts with owners generally provide that certificates shall be presented by the fifth of the month and paid by the owner by the tenth.

Subcontractors and material sellers also must be promptly paid by the builder for the various works performed. The builder's credit standing is an unusually important element, as subcontractors with unpaid accounts are properly insurgent against job discipline. Here again organization teamwork manifests itself, and the treasury by prompt payment of accounts due sustains the operating department in its plans for swift completion.

What form of contract best permits this great acceleration and intimate relationship with the architect and the owner? Certainly any basis on which the contractor is held responsible for the financial outcome would either involve the owner in inordinate extras and expenses or would bankrupt the contractor. The contract which carries such a stipulation would cause everlasting friction.

The fact is that the builder, the architect and the owner must produce the building jointly. The form of contract best suited to this purpose is the so-called cost-plus contract or a cost-saving agreement. Such a contract brings the three principal elements—the builder, the owner and the architect—into their proper relation one to another by basing their unity of interest on a flexible plan. Throughout a great building operation, such as that on the Empire State, hundreds of questions of changes and alterations have to be considered, which can only be solved by cooperation among the principals concerned. The builder, as the agent of the owner, completely adjusts the situations as to cost and their effect on subcontracts already let. The builder with a fixed contract, when similar questions arise, is immediately confronted with the risk of his own financial stake in the job. Naturally he protects himself, and controversy is inevitable.

Conclusions

Further detail would be tiresome. Twenty or more great skyscrapers in various stages of construction can be handled at once out of the experience and organization and team-work that has been developed in meeting the modern American demand for completion in the shortest possible time.

The business of the building company is one of vigilance in all these matters and of consciousness that perfection is never reached. Each job is organized just a little better than the last. Experience is handed on and improved upon. Mistakes are noted and danger signals posted on the shoals that experience has charted. The work cannot be done by a group of men who have simply had experience severally. It is in teaming together, working together, that the key men are developed in building operations.

Wind Design for 1,000-Ft. Tower Buildings

A discussion of the common methods of analysis and the present philosophy that emphasizes sway resistance in addition to strength, as exemplified most recently in the designs of the Empire State and Manhattan Company buildings in New York

HOW to make buildings adequately strong against wind pressure has become a distinctly new problem with the coming of the high tower buildings of the last three or four years. Conventional methods of proportioning and connecting the steel framework seemed to suffice so long as a height of about 500 ft. was not exceeded, but when buildings approached or passed 1,000 ft., and height ratios of 5 to 1, these methods were reconsidered and refined.

Structural engineers of supertall buildings are now giving consideration not only to strength but also to sway resistance. As the relation of the comfort of occupants to the frequency and amplitude of sway of the building is not known, sway is assumed to be proportional to static deflection, and a limit is set for the latter. Although the portal method of frame analysis has been applied extensively to buildings of considerable height, a modified cantilever method was adopted on the highest recent buildings. Full floor distribution is usually assumed. As stated, the basis for estimating the desirable degree of stiffness is not yet known, but present experience tends to establish the fact that a *stiff building is more comfortable than a flexible building,* and with this fact as a premise certain criteria have been set up for fixing the minimum stiffness.

Fig. 1—The 1,250-ft. Empire State Building in New York

One or two of the 40- or 50-story buildings of recent years that have rather small horizontal dimensions proved in actual experience to be flexible enough to make their sway in high winds perceptible to people in the upper stories. The solution of the problem is complicated, because it concerns not only the direct feeling of sway but the visible effect of sway in causing water in bathtubs to surge back and forth and suspended light fixtures to swing.

Recognition of the effect of real or fancied sway on occupants of buildings came to a few engineers some years ago, but only in the past three or four years has it shown any tendency to spread. This recognition led to the work of D. C. Coyle in devising and building an instrument of seismograph type to measure building sway, as recounted by him in this issue. It also led to attempts at more careful distribution of windbracing in new designs, although calculations were still based on strength (stress in members and connections) alone. Finally, when certain new building projects involved a probable great increase in window area and a partial or complete substitution of metal exterior covering with thin backing so that the contribution of the walls to the stiffness of the building would be lessened, the thought of setting up a definite rule for stiffness was taken up.

In both the 925-ft. Manhattan Company Building (*Engineering News-Record,* April 21, 1930, p. 291, and May 8, 1920, p. 756) and the 1,250-ft. Empire State Building (*Engineering News-Record,* Aug. 21, 1930, p. 280) the steel framework was so arranged and proportioned that the deflection of the tops of buildings under wind was limited; on the Manhattan Company Building, a limit of 2 ft. in 1,000 ft. of the height was used as a measure of adequate stiffness by H. V. Spurr, chief engineer of the structural engineering firm of Purdy & Henderson. In determining upon this figure Mr. Spurr assumed (1) that the variations of wind pressure which are effective in producing sway or vibration do not exceed 5 per cent of the maximum wind pressure itself, and (2) that the half amplitude of vibration is 5 per cent of the maximum deflection under full pressure. Knowing that certain high buildings give rise to no uneasy feelings among occupants, and calculating backward from the framework design, he concluded that a static deflection of 2 ft. in 1,000 was permissible. On the above assumption this would imply a maximum vibration of double amplitude 0.2 ft. (2.4 in.) at the top of a building 1,000 ft. high.

Mr. Coyle has been working along somewhat different lines. His observations cover about twenty high and relatively slender buildings, from two or three of which there have been occasional reports that tenants could feel sway during wind storms, while no such reports have come from the others. His sway-meter observations indicate that the oscillation frequencies of the buildings range from 8 to 30 or more (double) vibrations per minute; and that, for buildings of similar height and weight, those reported unsteady have noticeably lower frequencies than those which are satisfactory. He also concluded that slender buildings whose frame includes stiff diagonal or kneebracing have higher frequencies, whereas buildings whose height is eight or more times the base and whose bracing consists only of top-and-bottom end connections of girders have relatively low frequencies. Buildings designed for 30 lb. wind pressure showed higher frequency than those designed for a scant 20 lb. or 10 lb. per sq.ft. Application of these observations to actual tower-building design is pending.

Wind-Pressure—Design practice in tower buildings is based on building-code specifications for wind pressure. Under the code of New York City this calls for a pressure of 20 lb. per sq.ft. above the height of 100 ft. Other city codes specify pressures from 15 to 30 lb., usually for pure wind stress of 16,000 to 18,000 lb. per sq.in. and combined (load plus wind) stress up to 24,000 lb. per sq.in.

Both the Manhattan and the Empire State buildings were designed for the 20-lb. code pressure. In the upper part of the Manhattan tower superstructure, however, the steel stress was so reduced as to make the equivalent wind 30 lb., and detail parts of the building were proportioned for 40 lb. The "mooring mast" or observation tower section of the Empire State was proportioned for 30-lb. wind and an added horizontal force of 100,000 lb. at the tower top. No other allowance was made for increase of wind pressure with height, or for non-uniformity or gust action.

Wind-Stress Analysis—Two principal methods of stress analysis have been used almost exclusively in the wind design of high buildings, the cantilever method and the portal method.

In the cantilever method the steel frame of the building is considered to act as a vertical truss system fixed at the base and free at the top, with compression in the leeward columns and tension in the windward columns proportionate to their respective distances from the neutral axis. The web system (girders, end connections, kneebraces and diagonals) is assumed to be capable of transferring the chord-stress increments determined by the cantilever calculation; the girder moments are computed from these stress transfers, and the column moments from the girder moments.

This was the earliest method of wind-stress analysis, and in R. Fleming's compilation of current wind-stress methods published fifteen years ago it was listed and described as method No. 1. In later years it became less popular than the portal method, partly because the latter led more directly to a calculation of column and girder moments. In the last few years it has again been brought into prominence in connection with very high tower buildings.

The portal method, in its most usual form, takes account of the fact that column bending from wind is caused by the bending of the girders, and that, since the outer column is connected to only one girder while the inner columns are each connected to two, the inner columns will carry twice as large a bending moment, and therefore twice as large a shear, as the outer columns. Various modifications of the method are practiced, to allow for differences in column and girder section and in panel arrangement.

Occasionally the increased girder stiffness resulting from concrete incasement has been allowed for by an arbitrary increase of the moment of inertia of the bare steel—for example, by 25 per cent for stone concrete incasement.

Fig. 2—The 925-ft. Manhattan Company Building in New York

It may be noted that in a building whose girders are infinitely rigid while the columns are elastic, conditions similar to those of the cantilever method would prevail; in a building with elastic girders and rigid columns, the portal method would be approximated. Since the actual building has elastic columns and elastic girders, it might be assumed that the true stresses would lie between those computed by the two methods independently. This view has sometimes been advanced, but so far as known has not been applied to the design of an actual building.

Generally the practice has been to concentrate the wind resistance in wind bents, ignoring the stiffening effect of other bents or columns. Usual practice has arranged these wind bents so that their center of resistance (based on strength) coincided with the center of wind pressure, to eliminate torsion on the building. In a few cases, including the Empire State and Manhattan Company buildings, the resistances of the wind bents were taken to be proportional to their moments of inertia, each bent being considered as a vertical truss; a deep bent, in other words, was assigned a larger wind resistance than a shallow bent. The symmetry of resistance around the center of pressure was calculated on this basis. The details of the calculation were most simple in the Empire State, because of its symmetry and the unbroken column lines, which enabled all columns to be used as wind elements.

It has been general practice for many years to assume that the floor slab is capable of distributing the story increment of wind pressure to the several wind bents. Steel diagonals have rarely been provided in the floors except where a wind bent was offset and its load had to be transferred to another line of columns. The 1926 hurricane effect on buildings in Miami, Fla., gave the first convincing proof that even a weak floor slab could distribute the wind pressure effectively; since that time floor distribution has been more definitely recognized and has been made use of in several cases.

With effective full distribution by the floor slab, and rigid girder connections at all columns, it became theoretically possible to utilize every column for wind resistance without special attention to individual wind bents. Such a theory, which is not unlike the portal method theory, has been used on numerous buildings of medium height and some considerably taller, but it is frowned upon by some engineers. The theory implies that all columns must deflect equally at a given floor so that their flexure will be the same (floor assumed rigid) or nearly the same (floor not assumed rigid), and accordingly their resistances to the wind shear will be approximately proportional to their moments of inertia. Under this principle the total wind shear in a given story is equated to the sum of the column moments of inertia in that story, and the individual column shears are then computed from the individual moments of inertia. From the shears the column bending mo-

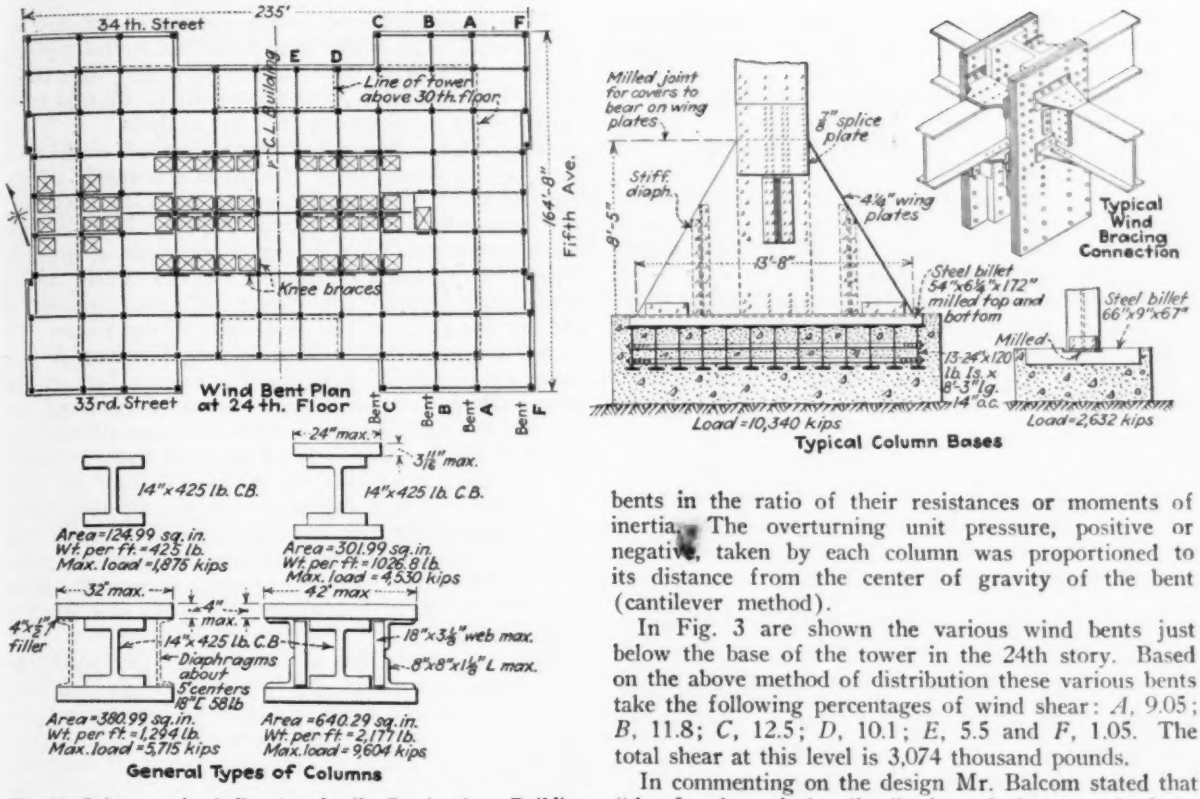


Fig. 3—Column and windbracing details, Empire State Building

ments are computed; the girder moments are equated and adjusted to these.

In several important buildings this method has been applied with an interesting modification. The column stiffness, taken as basis for distribution as just indicated, was computed not alone from the column section but from the column and adjoining girder sections in combination; the flexibility of the column (reciprocal of its stiffness) was added to the flexibilities of the girders connected to it, and the reciprocal of this sum was used in place of the stiffness of the column itself, as a basis for apportionment of wind shear.

The Empire State Building

The design of the 85-story 1,250-ft. Empire State Building in New York City was sketched a month ago by H. G. Balcom, its structural engineer, before the American Society of Civil Engineers. Conditions were particularly favorable on this building for the development of a well-braced frame. The plot was large and also rectangular. There were practically no offset column lines, and the service areas were concentrated near the center of the building. Sympathetic cooperation from the architects was of considerable assistance to the engineers in planning the structural framing. As a result practically all of the columns are braced in each direction on the center line, and deep kneebraces in the service areas are concentrated in the core of the building. Piers are founded on rock at a comparatively shallow depth.

Wind Design—For windbracing design a pressure of 20 lb. per sq.ft. above the sixth floor or 100-ft. level was used and 30 lb. above the 86th floor (1,045 ft.). The floor was assumed to act as a rigid horizontal plate that distributed the wind pressure to the various bents in the ratio of their resistances or moments of inertia. The overturning unit pressure, positive or negative, taken by each column was proportioned to its distance from the center of gravity of the bent (cantilever method).

In Fig. 3 are shown the various wind bents just below the base of the tower in the 24th story. Based on the above method of distribution these various bents take the following percentages of wind shear: *A*, 9.05; *B*, 11.8; *C*, 12.5; *D*, 10.1; *E*, 5.5 and *F*, 1.05. The total shear at this level is 3,074 thousand pounds.

In commenting on the design Mr. Balcom stated that "the figuring of the distribution of shears and of the bending moments in the various portal frames followed regular procedure, which gave the strength of wind brackets required at each point . . . All columns were figured for deflection, and the floor framing adjusted so that the deflections of each column under the computed load would produce as near equal deflections as practicable."

For the purpose of the present article Mr. Balcom amplified this statement in describing the design of the Empire State wind system. The tower is about 133x185 ft. in plan, with eight columns in lines north and south and ten columns in lines east and west. Cantilever calculations were made, assuming all columns in the tower area to be in action; no bent was singled out. This gave an approximate design on which an estimate of girder layout and proportions could be made. The estimate showed that the required girders would generally accommodate I-beam stub connections with eight 1¼-in. rivets; where more than this number of rivets was required to transfer the joint moment, a three-web column accommodating twelve rivets was substituted. The maximum direct stress in the columns due to wind was about 3,000 lb. per sq.in. Except at offsets, the only columns increased for wind load were the outer columns of the six lower stories. Kneebraces could be placed around the elevators, and in these bays the girders and kneebraces were so adjusted to each other as to furnish the desired rigidity.

The method used in this building evolved progressively from practice on earlier very high buildings. In one of the first of these, built about five years ago, a straight shear method was used, taking into account only the column stiffness (moment of inertia). In later buildings consideration was given to the flexibility of the girders as reducing the column stiffness. For a very narrow high building of still later date the cantilever

method was the basis of analysis, though much additional bracing was put into the framework for greater stiffness, on account of the extreme proportions of the building. As already noted, cantilever analysis was applied also to the Empire State Building, but this was an easier problem than the others because of the regularity of its structure.

Two types of wind connections were used—kneebraces and beam stubs or angles. The kneebraces, which provided the heaviest connections, were located adjacent to the elevators. Generally they were a full story in depth, which reduced the number of field rivets.

Structural Details—Mr. Balcom also described some of the special structural features of the building. Two main types of column bases were used. For loads not exceeding 2,600,000 lb., a heavy rolled steel billet, bearing

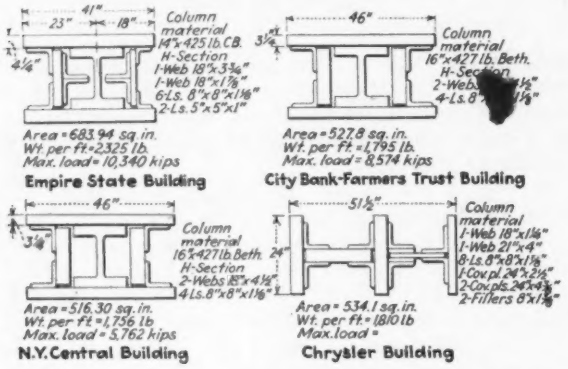


Fig. 4—Maximum columns in recent tall New York buildings

directly on the concrete, was utilized. For heavier loads, which in all cases exceeded 4,500,000 lb., the cover plates were cut at a point 4 ft. or more above the base, and wing plates of the same thickness as the covers were spliced in with milled joints so as to spread the load to the billet and grillage beams.

The Manhattan Company Building

In contrast to the favorable conditions existing on the Empire State Building for the development of wind resistance, the problem on the 71-story 925-ft. Manhattan Company Building at 40 Wall St., New York City, was complicated by an almost inflexible architectural layout that placed all service walls, such as those surrounding elevators and fire shafts, on one side of the tower, and by the existence of a large open banking room on the second floor.

Basis of Design—The general intent of the wind design, as stated by H. V. Spurr before the American Society of Civil Engineers, was "to secure in the web system a rigidity equivalent to a drift [deflection due to shear] of $0.001h$ with an average wind pressure of 15 lb. per sq.ft. applied to the structural frame.

"The strength of the design was inclined upward. A pressure of 30 lb. was used above the 60th floor and 20 lb. per sq.ft. from the eighth floor to the 60th floor in determining the horizontal wind shears and the axial column loads. The rigidity of the design on the basis of these loads was also inclined upward by maintaining typical kneebraces in the upper stories of the tower as demanded by shears at lower levels.

"The extreme top of the building was very carefully studied, and the design was based on the local effect of a wind pressure of 40 lb. per sq.ft. in the upper 100 ft.

"The members themselves were designed for stresses under wind alone which were controlled by the rigidity desired. In general these stresses were less than those allowed on the basis of strength. Rivet stresses were increased as is customary in wind analysis."

North-South Bracing—The problem of securing a symmetrical wind design (in which the center of resistance coincides with the center of wind pressure) was unusually difficult in this building because each wind bent required a different arrangement of bracing. In the north-south direction (Fig. 5) fairly ample opportunity existed for placing effective bracing in the service areas in the east half of the tower. To secure a symmetrical wind resistance, however, it was necessary to develop fully the four-column bent in the west wall of the tower, since the effectiveness of the interior bents in the open office area was reduced by virtue of the fact that eight of the main tower columns in these bents are picked up at the fifth floor on four trusses running east and west over the banking room and supported by free-standing columns through the banking room story. The west wall bent extends with little modification in type of bracing down to the fifth floor, where it is hidden in the west wall of the banking room.

The north-south line of columns on the west side of the service area in the east wall of the banking room could also be effectively braced by concealing the bracing in the permanent partitions. This bent by virtue of its location assists in reducing the wind load on

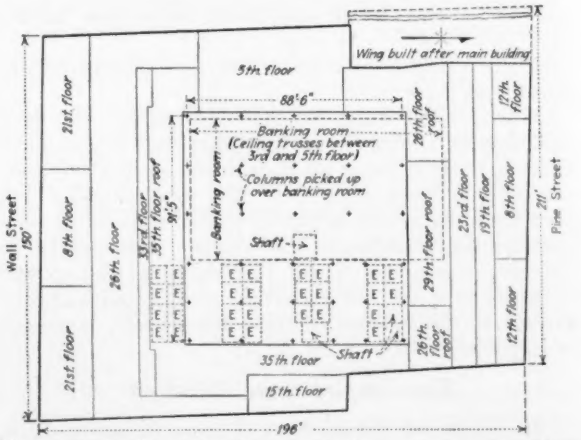


Fig. 5—Plan and setback diagram, Manhattan Company Building

the bent in the west wall of the tower. It is supplemented by two parallel lines of bracing, one in the service area between the elevators and the other in the east wall of the tower. In these various lines of bracing deep kneebraces and diagonals were utilized as far as possible, with connections using rivets in double shear.

East-West Bracing—In an east-west direction great reliance was placed on the bents in the north and south walls of the tower, but considerable rigidity was secured in this direction also by introducing deep braces where possible in the service areas, supplemented by deep connections to the webs of the columns in the open office area.

Some horizontal bracing members were also utilized in the third floor to develop additional lines of columns, in the base portion of the building, as effective wind bents.

NEWS OF THE WEEK

Law for Advance Public Works Planning Is Signed

Acting on the theory that now is a good time to fortify against future periods of depression, Congress has passed and the President has signed a bill to provide for advance planning of public works. This measure is the second of the Wagner bills to become a law. The first bill set up machinery in the department of labor for the regular compilation of statistics on unemployment. A third Wagner bill, which authorizes the establishment of a series of federal employment exchanges, has passed the Senate but has encountered opposition in the House on the ground that it is an invasion of state rights.

By means of the measure providing for advance planning of public works, it is hoped that government construction projects in mass can be thrown on the market at just the right time. Critics of the bill state that the difficulty will be to persuade government officials to anticipate periods of depression. While supporting the bill in every way, these critics doubt that the government will function before it is too late for the federal work to do much good.

To provide for prompt action in setting the governmental machinery in operation, the measure creates a planning board to be known as the Federal Employment Stabilization Board, to be composed of four cabinet officers. Under the terms of the bill, every department which regularly does any construction work will be required to prepare construction plans six years in advance.

Goudey Refuses to Serve in San Diego Sewerage Job

In compliance with the request of F. W. Seifert, who recently was awarded a contract by the city of San Diego, Calif., on his bid made in response to advertising by the city for bids from engineers for furnishing plans and specifications for a complete sewerage system for the entire city, permission has been granted by the city council to substitute Charles G. Frisbie for R. F. Goudey as the engineer in charge of the preparation of plans and estimates.

When the contract was awarded to Mr. Seifert he agreed to employ Mr. Goudey, who is sanitary engineer with the Los Angeles bureau of water-works and supply, or an engineer of equal capabilities. It has since developed that Mr. Goudey's name was used without his knowledge or consent or without his having been consulted about the matter.

The action of San Diego in advertising for engineering services was protested by the San Diego, Los Angeles and San Francisco sections of the American Society of Civil Engineers.

A.G.C. Seeks Change In Bill Maintaining Local Wage Rates

MOVED by disclosures of the present inability of government officials to prevent contractors on public work from importing cheap labor, the Senate recently approved a bill requiring that local wage rates be maintained on federal building work. The bill was introduced by Senator Davis, of Pennsylvania, until a few months ago secretary of labor.

A similar bill introduced in the House by Representative Bacon, of New York, has been reported out by the House committee on labor and is now on the House calendar. To expedite the passage of the measure, it is believed that the House leaders will allow the Senate bill to be substituted for the House bill.

Specifically, the legislation provides that every federal building contract in excess of $5,000 shall contain a provision requiring that rates of pay be observed that prevail in the community or locality where the work is being done. In cases of dispute as to what constitutes local wage rates, the secretary of labor will determine what the contractors are required to pay.

(Continued on page 338)

Washington Award Goes to Ralph Modjeski

For his "contribution to transportation through superior skill and courage in bridge design and construction" the Washington award for 1931 has been conferred upon Ralph Modjeski by the Washington Award Commission, which represents five of the leading engineering societies. Mr. Modjeski last year was awarded the John Fritz medal for distinguished engineering service (*Engineering News-Record*, Jan. 23, 1930, p. 129). He will be presented with the Washington award at a reception and dinner given by the Western Society of Engineers on Feb. 25.

Time Extended for Start on California Toll Bridge

Six months' extension for beginning construction on the proposed $15,000,000 Richmond-San Rafael bridge has been granted the San Rafael Ferry Co. by the board of supervisors of Contra Costa County, Calif., because of difficulty in making arrangements for financing. The war department has approved the revised plans for the construction of this toll bridge, which will be 18,000 ft. in length, with two 1,500-ft. spans over the main channel and a 200-ft. lift span.

NEW DEPARTMENT OF COMMERCE BUILDING, WASHINGTON

Wide World Photo

The building which will house the U. S. Department of Commerce in Washington is rapidly nearing completion and will soon be occupied. This picture shows the structure as it looks from the top of the Washington monument.

Railroad to Test Order to Extend Its Lines

An appeal will be taken to the U. S. Supreme Court on the question whether the Interstate Commerce Commission has authority to require a railroad to construct an extension into new and unprofitable territory. The U. S. District Court at Portland, Ore., recently vacated the commission's order directing the Oregon-Washington Railroad & Navigation Co., to build with Union Pacific funds 185 miles of line across the "high desert" in central Oregon at an estimated cost of $9,000,000.

The commission predicated its order on the provision of the interstate commerce act authorizing it to require a railroad, in performing its service as a common carrier, to provide adequate car service and "to extend its line or lines." The railroads construe this provision of the law as referring to construction of short extensions or branches to serve shippers in territory naturally tributary to their lines. They contend that under the commission's interpretation of the law it would have practically unlimited power to compel investment of private capital in construction in territory which they do not profess to serve.

New York Engineers Act to Raise Educational Requirements

Legislation designed to raise the educational qualifications required of engineer applicants for license in New York State was indorsed by the New York State Society of Professional Engineers at its regular winter meeting held in Albany, Feb. 9-10. The convention also gave its approval to the bylaws recently adopted by the state board of examiners in which a comprehensive set of written examinations for applicants not graduates of recognized engineering schools is outlined. Other matters considered for embodiment in legislation were the protection of the term engineer, restricting its use within the state to those who hold licenses as professional engineers, and the writing into the engineer license law of a proper definition of engineering.

At a dinner held at the close of sessions pending legislation was discussed with members of the state legislature present. Thomas C. Desmond, an engineer recently elected to the Senate, took an active part in this discussion, pointing out among other things some of the practical problems involved in getting the multiple dwelling law amended to remove the present discrimination against engineers.

Iowa Engineers Discuss Problems

Registration law, culvert engineering, secondary road administration and fair play for railroads among the subjects brought up for consideration

Engineering News-Record Editorial Staff Report

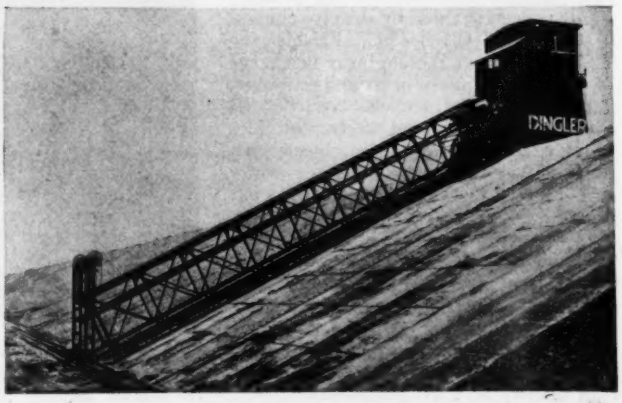
SUCCESSFUL secondary road administration, culvert engineering, frost boil theories, slab raising and bridge and building erection of unusual character formed the high-spot points of discussion at the Des Moines meeting Feb. 11, 12 and 13 of the Iowa Engineering Society. Other topics receiving attention were sewage disposal, airport landing forces, railroad problems and the ever-recurring one of tinkering with the engineers' registration law. Twice a year the examining board holds thorough written examinations. The "grandfathers" are all in and gradually will be outlived. The proposed New York law was discussed with suggestions that graduates of approved engineering schools be admitted and others examined thoroughly.

Iowa seems to have solved or be on the way toward solving the intricate problem of administering funds for secondary roads so as to get efficient use of the funds on the most-needed roads. As in most Middle Western states, the secondary roads in Iowa are under the township trustees and are "worked" by them. There being 36 townships 6 miles square in a normal prairie county with three trustees each, the administration of the road funds derived from tax levies, poll tax and a proportion of the state gas tax is likely to be inefficient and discriminatory. A recent law put the making of a budget and program and the handling of construction largely in the hands of the county engineer, who is appointed by the county officials.

Improved Road Mileage Increased

C. C. Coykendall, administration engineer, Iowa state highway commission, having oversight over the work in which the gas tax aid appears, stated that with less money than the average in the previous three years much more work has been done. More than 22 million dollars was spent on these secondary roads; 41.4 per cent went into construction. Nearly 3,400 miles were graded ready for surfacing, 2¼ times the three-year average. A total of 5,237 miles was improved (graded or graveled), an increase of 50 per cent. Mr. Coykendall noted that in only a few of the 99 counties politics seriously interfered either with location of the proposed improvements or carrying out the work. A few counties are doing work by day labor, but the difficulty of shaking off job holders in the winter and the ease with which an oversupply of equipment may be acquired deter the wiser engineers from going into force account work rather than doing it with

MACHINES DIG AND LINE CANAL



Two unusual German machines building a new canal between Strassburg, Alsace, and Basel, Switzerland. That on the left shapes the bank, removing or placing material and tamping it. Excess excavation in cuts is automatically loaded into a train on top of the embankment. In fill, the operation is reversed and earth is transported from the cars to form the bank. The second machine follows the first, its purpose being to place a concrete lining along the embankment. It mixes, places and rolls approximately 300 cubic meters of cement in an eight-hour shift, and at the same time places wire net reinforcing.

contractors. The most heartening thing about the reports from the various county engineers was the evident passing of the township trustees or at least their hold on the roads.

About 200 sections of settled pavement slabs have been raised by the mud-pump method, said W. H. Root, maintenance engineer, state highway commission. This procedure, which was described in *Engineering News-Record* Dec. 18, 1930, p. 979, has been applied to 18,586 sq.yd. of concrete, lifting the slabs from 3 to 15 in. at an average cost of $1.02 per square yard. The jacking method costs $1.75 and the black top methods $0.95. It is hoped that settlement can be predetermined and prevented by sounding the pavement for hollow places, which can then be grouted with the mud pump.

Culvert Engineering

"Culvert Engineering," a paper by M. G. Spangler, associate structural engineer, Engineering Experiment Station, Iowa State College, stressed the importance of the subject; 45 per cent of the cost of bridges and culverts in the state in 1929 and 1930 went for culverts. Basic principles of flood runoff and streamflow, economics of probable life, external loads, cross-section, character of bedding and methods of construction were all covered, and there was a long discussion on load due to settlement. W. J. Schlick, drainage engineer of the station, followed with a paper giving in usable form all of the formula and coefficients normally encountered in culvert design.

Q. C. Ayres, associate professor of agricultural engineering, Iowa State College, outlined the present theories of frost heave. (See *Engineering News-Record*, Feb. 12, p. 266.)

Under the auspices of the structural-architectural section three illuminating papers largely relating to erection were presented. The jobs were the Empire State Building, the construction of five 206-ft. reinforced-concrete arch spans without falsework at Cotter, Ark., and the demolition of the Yadkin concrete bridge by artillery fire. J. M. Tippee, city engineer, Des Moines, described the rebuilding and refinishing of the twenty-year old reinforced-concrete Locust St. bridge in the heart of the city. Shelling off of the piers and under side of the spandrel arches due to frost was repaired with gunite. A new pavement on a waterproofed subgrade was laid. A new hand rail with camber replaced the old one, which had weathered.

Plea for the Railroads

At the annual dinner George E. Hise, president of the Iowa Bar Association, read an exhaustive paper on the problems of the railroads, in which he made a strenuous plea for fair play and equal opportunity in the competitive race for business by the railroads, boat, bus, truck and pipeline operators. He deplored the government subsidies, as he called them, to operators of boats on inland waterways, and private buses and trucks on public highways, with the facilities partly financed from taxes to which the railroads contribute heavily. As to regulation, he felt that buses, trucks and pipelines should be regulated more and perhaps the rails less, to put competition on a more even basis.

The society bylaws were amended to provide for intersociety interchange of membership. This provision permits any member of a sister society to transfer to his same grade in the Iowa Engineering Society. The "recommended uniform registration law" amendments were approved as applicable to the Iowa law. The legislative committee was instructed to contact the proper members of the state legislature, now in session, with a view to their presentation and adoption.

The newly elected officers are as follows: president, Raymond Zack, district engineer, Iowa state highway commission, Mason City; vice-presidents, Howard R. Green, consultant, Cedar Rapids, and G. M. Griffith, county engineer, Iowa City; secretary-treasurer, J. S. Dodds, associate professor of civil engineering, Iowa State College, Ames.

Engineers Named on Plans to Rebuild Corpus Christi Dam

Henry E. Elrod and Robert J. Cummings, consulting engineers, have been retained by the city of Corpus Christi, Tex., to collaborate on the preparation of plans for the reconstruction of La Fruta dam, which partly failed on Nov. 23, 1930. Reports of the failure and the causes were published in *Engineering News-Record*, Nov. 27, p. 861, and Dec. 18, p. 974.

MODERN SKYSCRAPER IN HOLLAND

Wide World Photo

This building, the first skyscraper in Holland, is being built in the town of Rotterdam. It will house the Rotterdam Electric Co., which will supply the surrounding neighborhood with electricity. On account of the low level of the country, the building had to be erected on concrete piles.

Building Elevators Planned for 1,000 Ft. Per Minute Speed

A schedule which calls for a total day's run of 171 miles at a top speed of 1,000 ft. a minute has been adopted for automatic control elevators in the 42-story office building under construction at 22 East 40th St., New York City, by the Houston Properties Corp. The elevator schedule has been based upon an estimate that 15,000 persons will ride up or down each day. It is expected that by April 1, when the building is to be completed, the present city regulation limiting elevator speeds to 700 ft. a minute will be modified.

The architect, Kenneth Franzheim, reports that the maximum distance from offices to elevators is 50 ft. on the lower floors of the building, and 6 ft. on the tower floors. With normal traffic conditions, it will take only 50 seconds for a tenant on the 42d floor to reach the street entrance of the building, according to Mr. Franzheim.

San Francisco Voters Approve Special Employment Bonds

San Francisco voters at the special election Feb. 6 approved the $2,500,000 employment bonds by a seven to one vote. This bond issue is designed to give work to thousands of San Francisco residents in a citywide improvement program. For the improvement of paths and roads in public parks and squares $1,400,000 is to be expended; $900,000 is for road and highway construction; and $200,000 for playground improvements.

According to reports from the city engineer's office, approximately 1,500 men were to be put to work Feb. 10, and the number is expected to be increased until approximately 4,000 will be working each week. It is hoped by this method to have the full number of registered unemployed at work every other week.

Seeking to relieve the unemployment situation in Los Angeles, the city council has set March 5 for a special election on a $5,000,000 bond issue to provide money for labor on many needed public improvements.

Suggests Cutting Housing Costs by Standardization

In connection with its studies on housing the Regional Plan of New York and Its Environs has published a report by Grosvernor Atterbury, architect and city planner, on "The Economic Production of Workingmen's Homes." Mr. Atterbury argues for standardization and factory mass production, which, he says, would eventually cut the cost of building the simplest types of housing by 50 per cent. He bases his figures partly on actual experimental results achieved at Forest Hills Gardens, Queens County, where nearly 40 houses were built from standardized factory-made sections.

Would Amend Wage Rate Bill

(Continued from page 335)

The comptroller general has ruled that contractors cannot now be legally required to observe existing wage scales. The passage of this legislation however, would necessitate inserting a clause in federal building contracts requiring that local wage rates be maintained. This would then become one of the conditions of the contract to be agreed to by the prospective contractor in submitting his bid.

Contending that the bill would lead to manipulation of wage rates at the expense of responsible elements of the construction industry, the Associated General Contractors has submitted a petition to President Hoover urging that the measure be modified. While not opposed to the substance of the bill, the A.G.C. desires to see it amended by insertion of a requirement that heads of departments specify the wage rates to be paid before the advertisement for bids. The present form of the bill leaves the way open for certain elements of the construction industry to force the successful bidder to make concessions by holding the threat over him of raising wages, the A.G.C. believes.

Public Works Survey Forecasts Increase in 1931

Engineering News-Record's public works survey for 1931 forecasts an increase of 20 per cent over 1930 and 34 per cent over 1929. The exact data are shown below for town, county, state and federal work for the three years:

	1929	1930	1931
Municipal..	$451,537,000	$428,806,000	$464,586,000
County	72,291,000	81,253,000	119,542,000
State..	767,681,000	1,019,255,000	1,094,701,000
Federal	361,030,000	323,068,000	528,974,000
Commission..	16,549,000	14,118,000	30,158,000
Total	$1,669,088,000	$1,866,500,000	$2,237,961,000

Coverage for the years is highly comparable. State figures include all state road work and other construction for seventeen states having population of 48 millions in 1929; nineteen states of 50 millions in 1930, and 24 states of 56 millions in 1931. Similar data for municipal and county work are given below:

	Number			Population in Millions		
	1929	1930	1931	1929	1930	1931
Municipal	234	267	263	31	31	30
County..	84	119	127	16	18	17

Concrete Pavement Yardage

Appended below is a tabulation of the concrete pavement awards in the United States for the month of January, 1931, classified according to roads, streets and alleys:

	Sq.Yd. Awarded During January, 1931
Roads	9,218,269
Streets	845,829
Alleys	43,379
Total	10,107,477

230-Ton Steel Casting Sets a New Record

A single-piece steel casting weighing 460,000 lb. and believed to be the largest ever made was completed, ready for erection, at the Bethlehem plant of the Bethlehem Steel Co. on Feb. 16. The casting is a cylinder jacket for the 14,000-ton forging press in the company's plant. It is 12 ft. 10 in. high, 23 ft. 4 in. long and 10 ft. 2 in. wide. Six open-hearth furnaces were used for the melting of the steel for the required metal, which was deposited in ten minutes through four troughs, one at each end of the mold and two at the side.

The forging press for which the casting was made has been in service since 1893. Before the war it was used exclusively for armor plate forging; recently it has turned out heavy forgings for pressure vessels used in the oil and chemical industries. Helium tanks for the army and navy have also come from the press, which has a capacity of about 12,000 tons annually. Early in December the old cast-iron cylinder jacket, made up of several small castings, cracked, and work was immediately started on patterns for a new steel casting.

Largest steel casting ready for machining

The total job has consumed about ten weeks. Some 13,000 ft. b.m. of lumber was required for the patterns. The mold was made in a large concrete pit with heavy steel reinforcing over the full surface. Adjacent pits were filled in and reinforced to assure adequate lateral resistance. To provide rapid cooling of the molten metal as it came in contact with the mold, 2 tons of nails were used over the surface of the mold. The mold was dried by a special pipe and blower system.

The larger cores, for the cylinder holes, weighed 60 tons each. All cores were double-bricked shafts. The cope or superstructure that is added to the mold to accommodate the extra metal needed because of contraction of the metal in the mold was loaded with 1,000,000 lb. of weight to assure against floating of the cores. The surplus portion of metal or sinkheads was made up of cast iron, because of an accident which left only five ladles of steel available. After the casting had been in the mold ten days the sinkheads were cut off and the cope was removed. The total pouring time, including sinkheads, was 38 minutes.

Annealing and machining were done in the forge department. Annealing required nine days with a top temperature of 1,300 deg. F. For the machining operation six machines were brought from the machine shop and set up on special foundations around the casting. Erection will constitute a major problem, since the 230-ton mass must be lifted 55 ft. in the air to set it over the press columns. A special steel tower carrying two 125-ton shop cranes has been erected for this purpose.

L. S. Buffington, First Exponent of the Skyscraper, Dies

Leroy S. Buffington, of Minneapolis, who claimed to have originated the idea of skyscraper building, was found dead in bed on Feb. 16, having suffered a heart attack. Mr. Buffington, who was 83 years old, was born in Cincinnati and was educated as a civil and mechanical engineer. He went to Minneapolis in 1869 and began work as an architect in St. Paul two years later. He was the architect of many of Minnesota's state buildings, and he also designed the capitols of North Dakota and West Virginia, besides Minnesota's old Capitol and many of the older buildings of the University of Minnesota.

In the early '80s Mr. Buffington began work on the tall building idea, evolving a plan of what he called a "cloud-scraper," in which the masonry veneer was supported at each successive story on an iron shelf. In 1888 he obtained a patent on his idea, but he realized scarcely nothing therefrom in a monetary way. He was the subject of considerable ridicule when his scheme became public, the New York *Sun* saying in 1888: "L. S. Buffington, an architect, is building a wonderful building on paper which is to be 28 stories high. To be sure, this is probably the project of a crank, but the cranks of one generation are sometimes the prophets of the next."

American Concrete Institute Meets in Milwaukee Next Week

The 27th annual convention of the American Concrete Institute will be held at the Schroeder Hotel, Milwaukee, Wis., Feb. 24-26. Six sessions will be held during the three days. Among the important subjects to be discussed are lightweight concrete, admixtures and workability, sizes and combinations of aggregates for road work, ready-mixed concrete, operation of central mixing plants, and bulk cement. Concrete work at the Diablo Dam and at the new 20-m.g. water reservoir at Detroit will be described in special papers. Duff A. Abrams is president of the institute. Kenneth H. Talbot is in charge of local arrangements for the convention.

Bethlehem-McClintic-Marshall

Three McClintic-Marshall executives will assist G. H. Blakeley, formerly vice-president of the Bethlehem Steel Co. and now president of Bethlehem's new fabricating subsidiary, McClintic-Marshall Corp., in the management of the latter organization, according to latest announcement. Elbert A. Gibbs will be vice-president in charge of operations; Charles M. Denise will be vice-president in charge of sales, and E. J. Patterson will be vice-president and treasurer. These positions correspond to those held by these men before the consolidation. Mr. Gibbs has been with McClintic-Marshall since 1907, when he entered the estimating department. In 1908 he was placed in charge of the department and in 1910 was manager of erection west of Harrisburg. He was made general manager in 1919 and vice-president in 1929. Mr. Denise has been in charge of sales since 1919. For fifteen years beginning in 1904 he was in charge of the company's Chicago office. Previous to 1904 Mr. Denise was with the old Shiffler Bridge Co. Mr. Patterson entered the employ of McClinic-Marshall in 1902 as auditor. All of these executives, now located in Pittsburgh, will have offices at the Bethlehem plant. No decision has been announced as to the location and setup of the engineering force of the new organization.

Contract Awarded for Power Development in Quebec

Announcement is made of the award of the contract for construction of the Maclaren-Quebec Power Co.'s new hydro-electric development at Masson, Quebec, to the Foundation Company of Canada, Ltd., Montreal. This development will have an installed capacity of 130,000 electrical horsepower operating under a head of 185 ft. In addition to the power house, the work will include building a dam, control works and intake on the Lievre River and driving a 25-ft. tunnel more than a mile long through solid rock 200 ft. below the surface. The plant is to be completed ready for the delivery of power by July 1, 1933.

Hudson County, N. J., Adopts Smoke Ordinance

The board of health and vital statistics of Hudson County, N. J., has adopted a smoke ordinance, prohibiting the making of dense smoke within the limits of the county, and establishing a department of smoke regulation in charge of a smoke abatement engineer. Included within the limits of the county are Jersey City, Bayonne, Hoboken, Harrison and Weehawken.

By the ordinance dense smoke, fly-ash or fumes from any smokestack or open fire, except that from a locomotive or steamboat, is prohibited for more than two minutes in any period of fifteen minutes. Dense smoke is defined as being equivalent to No. 3 or greater on the Ringelmann chart, or as being so thick at the point of emission that it cannot be seen through. The ordinance also prohibits smoke equivalent to No. 2 of the Ringelmann chart from any stationary plant or open fire for more than twelve minutes in any period of one hour. No. 2 smoke is defined as being so dense that it can be dimly seen through. From a locomotive or steamboat, dense smoke is prohibited for more than 30 seconds in any period of three minutes. No. 2 smoke from a locomotive or steamboat is prohibited for more than four minutes in any period of fifteen minutes.

Any person or corporation violating the ordinance is subject to a fine not exceeding $50, or imprisonment for not more than 30 days, or both. Each day's violation constitutes a separate offense.

Coast State Legislators Seek Uniform Traffic Laws

A meeting of members of motor vehicle, road and highway committees of the legislative assemblies of California, Oregon and Washington was held in Portland, Ore., Feb. 6 and 7, to discuss standardization of traffic laws in the three coast states. A permanent organization to be known as the Pacific Coast Motor Vehicle Association was formed. H. B. Van Duzer, chairman of the Oregon state highway commission, was elected president and T. Ray Conway, Oregon State Motor Association, secretary.

All questions of traffic rules, including speed limits, turning at intersections, entering arterial highways, signals and other matters, were discussed. The association will meet once a year.

The Business Outlook

The sudden routing of the bears in Wall Street and reversal of bearish sentiment in other commodity markets have raised hopes of an early turn in the business tide. Evidences of much trade improvement are still slight, but perhaps sufficient to excuse the eager turn of sentiment. A rising backlog of steel orders, somewhat better than seasonal levels in car loadings, bank debits, currency in circulation, and commercial loans, a firming of some commodity prices and increasing bank bond investments are encouraging. Revival of the Russian embargo agitation and renewed disturbances in Germany, however, suggest that some of the larger problems looming in the background have still to be reckoned with.

—The Business Week, Feb. 18

WASHINGTON NOTES

By PAUL WOOTON
Washington Correspondent

U. S. to Pay for Relocation of Mississippi Levees—New Plan For Flood Control Being Studied

BY UNANIMOUS vote the flood-control committee of the House of Representatives on Feb. 14 ordered a favorable report on the Wilson bill, providing for payment by the United States of all damages occasioned by the relocation of levees on the Mississippi River. The bill provides, however, that the local interests must furnish without cost to the United States all rights-of-way for levee foundations on the main stem of the river. It also provides that they are to maintain levees after their completion and to take care of all local drainage.

New Flood-Control Plan Not Ready

In the absence of Major Gen. Lytle Brown, Chief of Engineers, Secretary of War Hurley has been unable to assure the flood-control committee that the report covering the restudy of the Mississippi flood-control plan would be ready for submission prior to March 4. Secretary Hurley told the committee that the board of engineers for rivers and harbors had completed its work on the report Feb. 10 and had turned it over to General Brown. It is known that General Brown has been keeping in close touch with the report and is thought to have the 31-page summary of it with him on his trip. He does not expect to return to Washington until Feb. 24 and it is thought that he will require a few days after his return to formulate his own views. Secretary Hurley told the committee that he already had formed his own conclusions as to what ought to be done but that he did not believe it wise to express them in anticipation of the report.

Domestic Supplies for the Army

As the result of protests of officials of the executive departments, the Senate appropriations committee struck from the war department appropriation bill an amendment inserted on the floor of the House that would have limited army expenditures to the purchase of goods and materials produced in this country. The Senate committee substituted language that considerably softens the proposals put forth by the House for the use of American materials. This substitute amendment was approved by the Senate when it passed the bill. The measure now goes to conference, where it is believed that the Senate amendment will prevail. In its modified form, the bill simply directs the secretary of war to see that purchases are limited to the United States for work within the limits of the country, when in his discretion such a policy will serve the best interests of the government. The present public contract act provides that American goods must be favored.

Brief News

VOTERS of Fullerton, Calif., on Jan. 20 indorsed a proposition for inclusion of the city as a part of the Metropolitan Water District of Southern California. The result of the election was: yes, 1,369; no, 93. The action of the Fullerton voters brings the number of cities included in the water district to twelve.

INVESTIGATION of the effects of high temperature on metals will be undertaken by the Engineering Foundation in conjunction with the American Society of Mechanical Engineers and the American Society for Testing Materials. The investigation, for which $20,000 has been appropriated, will continue for two years.

GROUNDWORK is well under way at Oklahoma City's new $425,000 municipal bond issue airport, following clearing of litigation, release of funds, purchase of a new location, redrawing of ground and building plans and letting of part of the contracts.

BUILDING A BRIDGE across Chesapeake Bay is a subject that will receive considerable attention by the Maryland general assembly. One proposition is to create a bridge commission to develop a program covering construction of important toll bridges in the state. It is estimated that a bridge across the Chesapeake would cost about $12,000,000.

FOUNDATION and excavation work has been started on the San Francisco War Memorial, located between Grove and McAllister Sts. on Van Ness Ave. A $4,000,000 bond issue was voted in 1927 for this purpose, and the remainder of the construction will be taken care of by donations. Construction has been held up because of disagreement on the architectural plans.

Personal Notes

R. R. HOLLAND has been appointed vice-president of engineering construction, and V. G. YOUNGHUSBAND vice-president in charge of building construction, by the Foundation Company of Canada, Ltd. Mr. Holland joined the staff of the company in 1920 and during the last five years has held positions of responsibility in connection with the hydro-electric undertakings of the company.

J. W. LEROUX, of Tampa, Fla., for the past six years district manager for Florida of the Nashville Bridge Co. and for the twenty preceding years district manager in Atlanta for the Virginia Bridge & Iron Co., is now engaged in engineering contract-sales service, with headquarters in Tampa.

BYRON E. WHITE, of Utica, N. Y., has been appointed division engineer of the central division of the Niagara Hudson Power System. Mr. White for the last 25 years has been in the engineering department of the Utica Gas & Electric Co., during the last several years general engineer. M. H. PRATT, chief engineer of the Syracuse Lighting Co., has been designated as Mr. White's assistant.

CONRAD L. WIRTH, for the past three years assistant to the director of planning of the National Capital Park and Planning Commission, has been made assistant director of the National Park Service, in charge of the lands branch.

C. D. MEALS, formerly chief engineer of the American Cable Co. and wire rope engineer of the Roebling Co., has taken charge, as president and general manager, of the newly formed Wire Rope Corporation of America, Inc., of New Haven, Conn. Identified with him will be A. F. HAURY, formerly associated in an engineering capacity with the American Cable Co. and the American Steel & Wire Co.

JAMES S. BURCH, recently investigator for the special committee on subgrades and pavement bases of the American Road Builders' Association, has been appointed research engineer of the Wire Reinforcement Institute.

EDGAR A. ROGERS has been placed in charge of the new branch of Ford, Bacon & Davis, Inc., in Cleveland, Ohio. Mr. Rogers was formerly manager of the Philadelphia office, and is succeeded in that city by SHIPLEY THOMAS, formerly vice-president of the Benedict Stone Co., New York.

SOCIETY CALENDAR

AMERICAN CONCRETE INSTITUTE, Detroit; annual convention, Milwaukee, Feb. 24-26.

AMERICAN RAILWAY ENGINEERING ASSOCIATION, annual convention, Chicago, March 9-12.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia; regional meeting, Pittsburgh, March 18.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York; spring meeting, Norfolk, Va., April 15.

AMERICAN WATER WORKS ASSOCIATION, New York; annual convention, Pittsburgh, Pa., May 25-29.

COLORADO SOCIETY OF ENGINEERS has elected the following officers: president, John S. Marshall, chief draftsman, Colorado state highway department; vice-president, G. H. Garrett, engineer, Thompson Manufacturing Co.; secretary-treasurer, C. M. Lightburn, valuation engineer, Denver & Rio Grande Western R.R. (reelected).

CONCRETE REINFORCING STEEL INSTITUTE will hold its annual meeting at Biloxi, Miss., March 16-18. Papers will include "Tall Concrete Buildings" and "Reinforcement of Concrete Paving." M. A. Beeman, Chicago, is secretary.

NEW YORK STATE SEWAGE WORKS ASSOCIATION will hold its third annual meeting in Albany on March 5. The tentative program includes a paper on the operation of the Freeport, L. I., sewage-treatment works by Lawrence H. Luther and a symposium on sludge, digested and otherwise.

SEATTLE SECTION, American Society of Civil Engineers, has elected the following officers: president, William F. Way; vice-president, E. L. Srandberg; secretary-treasurer, Thomas D. Hunt.

STRUCTURAL ENGINEERS' ASSOCIATION OF SOUTHERN CALIFORNIA has elected Prof. R. R. Martel, of the California Institute of Technology, Pasadena, president, Oliver G. Brown, Pasadena, vice-president, and Robert J. Hiller, Los Angeles, secretary-treasurer.

Obituary

JOSEPH D. METCALFE, division engineer of the Texas highway department, stationed at Paris, Tex., died on Feb. 2. He was 45 years old.

EDWARD GAGEL, chief engineer of the New York, New Haven & Hartford Railroad for 24 years, died at his home in West Haven, Conn., on Feb. 11, of heart disease after several months' illness. Mr. Gagel was 73 years old. He had been connected with the New Haven road for 47 years, retiring two years ago.

CHARLES WARREN CROSS, senior highway engineer in the U. S. Bureau of Public Roads at Ogden, Utah, died suddenly on Feb. 9 from a heart attack. Mr. Cross, who was 56 years old, had been stationed in Ogden since 1919. Prior to that he was city highway engineer of Oakland, Calif.

WILLIAM G. STONE, civil and consulting engineer, died at his home in Utica, N. Y., on Feb. 12. Mr. Stone specialized in water supplies and filtration, and designed water systems in scores of towns and villages in New York State. For several years he was consulting engineer for water systems in Brockport, Seneca Falls, Waterloo and Holley. He was 81 years old.

MILTON W. WILBUR, of Columbus, Ohio, died on Feb. 7 at the home of his daughter in Rochester, N. Y. For the past thirteen years Mr. Wilbur had been senior highway engineer for the U. S. Bureau of Public Roads, with headquarters at Columbus, Ohio. Before that he was for many years connected with the New York state highway department.

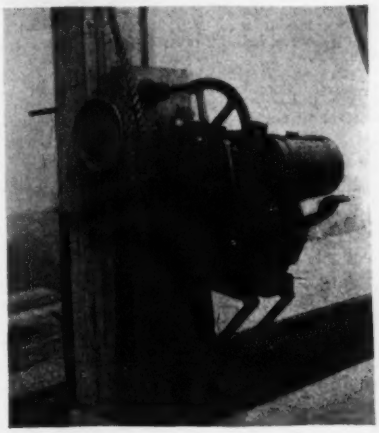
FRED L. WEEKS, professor in the engineering department of the North Dakota Agricultural College, died on Feb. 7 in Fargo, N. D. He was 42 years old. Prof. Weeks was a native of Kansas and was graduated from Sheffield scientific school, Yale University, in 1911. At one time he was assistant engineer, maintenance-of-way, of the Great Northern Ry. at St. Paul, Minn. He had been on the faculty of the North Dakota Agricultural College for five years.

RICHARD MONTFORT, chief engineer of the Louisville & Nashville R.R. at Louisville, Ky., died on Feb. 7 in Atlantic City, where he had been visiting for several months. Mr. Montfort received his degree from the engineering division of the University of Dublin and went to Louisville in 1880, joining the Louisville Bridge & Iron Co., bridge builder and fabricator. He joined the staff of the Louisville & Nashville in 1884, becoming chief engineer in 1918. At the time of his death Mr. Montfort was consulting engineer for the railroad. He was a member of the American Society of Civil Engineers, having been a director in 1914-16, and vice-president in 1916.

Construction Equipment and Materials

Simple Portable Hoist

Ready portability and simplicity in installation are features of the Wyman portable hoist, a gasoline-powered machine designed to lift 500 lb. on a single line pull at a speed of 72 ft. per minute,

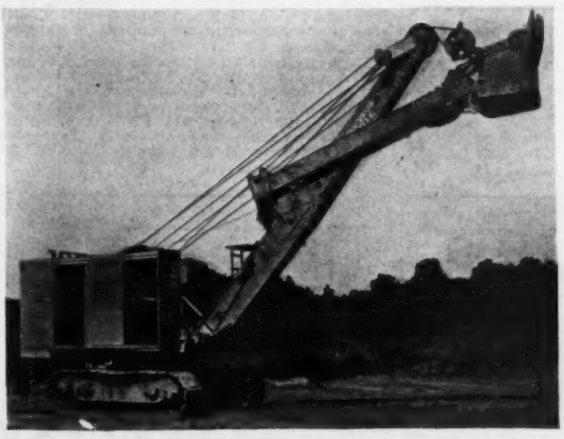


Gasoline powered hoist

which is now being distributed by the Interstate Equipment Corp., 333 South St., Newark, N. J. The unit, which was designed by Robert Wyman, of Billerica, Mass., weighs but 75 lb. and is powered with a 1-hp. Briggs & Stratton gasoline motor. Operation is over a direct-connected niggerhead.

Three Power Sources Available for 1½-1¾ Cu.Yd. Excavator

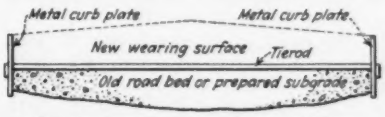
Among the options available on the 43-B shovel - dragline - crane - clamshell recently announced by the Bucyrus-Erie Co., South Milwaukee, Wis., are diesel, gasoline or electric power; rope or chain crowd; and regular or special crawler equipment. Standard design features include unit steel construction, ball bearings on all continuously running shafts, oversize clutches, inclosed gears running in oil, single-shaft-drive crawler mounting, centralized control and full vision cab.



1¼-1¾ yd. power shovel

Metal Highway Curb Confines Surfacing Material

Resurfacing and repair jobs, as well as new highway construction, can be greatly simplified by a metal curb design developed by W. H. Moseley, of Springfield, Ill., which is manufactured and sold by the American Rolling Mill Co., Middletown, Ohio. Principles of application are shown in the illustration. In general terms, a continuous metal curb, the design of which can be varied to suit different conditions, is laid along the edges of the paved surface, fastened in place by stakes or anchoring rods and tied together by a series of transverse rods. When resurfacing old roads, the metal curb bears against



Principle of metal curb installation

the edge of the old pavement, projecting a sufficient distance to confine the brick or bituminous material used for the new surface. For new construction the curb is installed directly on the subgrade. In both cases the transverse rods are buried in the paving or surfacing material. Advantages claimed for the new device include decreased cost, ease of installation, adaptability to all types of construction, safety and reduced maintenance cost by the prevention of raveling along the edge of bituminous pavement. The metal used is Armco iron.

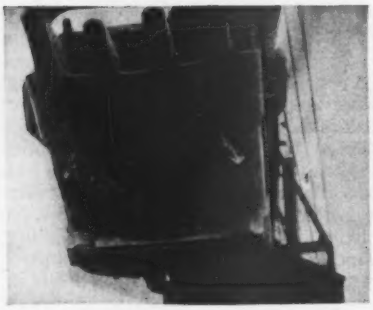
1-Cu.Yd. Skimmer-Pullscoop Has Full Revolving Mounting

A convertible 1-cu.yd. revolving power shovel designed especially for operation with skimmer or pullscoop buckets, but also adaptable to crane, dragline or bank scoop operation has been developed by the Keystone Driller Co., Beaver Falls, Pa. This unit is crawler mounted, the upper structure being tied to the crawler through an exceptionally large roller path, 71 in. in diameter, with hold down shoes which give the unusual stability needed for accurate control of the skimmer bucket in grading. The boom used for skimmer or ditcher operation weighs only 2,500 lb., giving a low boom and bucket load and shortening the tail swing to 8 ft. 6 in. The entire unit weighs about 28 tons. As a skimmer the standard bucket has a capacity 1 cu.yd., but an oversize bucket of 1¼-cu.yd. capacity can be furnished. In ditching, the machine handles a range of buckets varying in width from 24 to 72 in., those from 48 to 72 in. being oversize. Power is provided by a Climax Blue Streak gasoline motor developing 82 hp. at 960 r.p.m. This gives a traction speed of 75 ft. per minute, and a swinging speed of 5½ r.p.m. Depth capacity with the ditcher bucket is 20 ft. All buckets are operated by slipping friction control, giving a variety of speeds to meet various digging conditions.

Full revolving 1-cu.yd. skimmer excavator

Scraper Blades on Bucket Speed Grading Operations

An exclusive license to manufacture and sell the Voit dipper front, patented by Grover C. Voit, of Hopedale, Ohio, has been granted to the American Manganese Steel Co., Chicago Heights, Ill. This front has provision for several scraper blades, one of which is placed transversely at the heel of the bucket, two others in a V-arrangement farther forward, while an additional longitudinal blade can be mounted between the V-blades if desired. Sockets holding the blades are cast integrally with the bucket front, the blades themselves being held in place by wedge-shaped parts riveted into the sockets. The pur-



Scraping blades on excavator bucket

pose served by the blade is to facilitate the smoothing and grading of the excavation pit, as well as side slopes in open-cut work. In addition, the rear blade serves to protect the dipper latch from mud and other material. Voit fronts of manganese steel can be made for any style or size of dipper.

Clearing Excavator Buckets of Sticky Material

Clay and other materials which have a tendency to stick to excavator buckets can be removed by means of a new clean-out device developed by George Haiss Mfg. Co., Inc., New York City, for use on the Haiss excavator. Teeth or prongs mounted on a swinging shaft are placed on an extension of the elevator frame. As the buckets revolve around the head shaft these prongs enter each one at the inside of the teeth. The motion of the bucket pushes the

Cleaning device for bucket excavator

prongs through the clay, which is thrown off. Heavy springs are used to return the prongs to position, ready for the next bucket. In order to soften the impact of this return, Houdaille shock absorbers are used. Elements of the machine are so balanced that the teeth return to rest in time for each succeeding bucket without respacing, and there is no rebound or shock to the machine. The entire structure is heavy enough to stand the work, and cannot get out of adjustment, because the swinging shaft is so linked to the head shaft that it is impossible to adjust one without the other.

COSTS AND CONTRACTS

E. N.-R. Index Numbers

Cost			Volume		
Feb. 1,	**1931**	**196.61**	**January,**	**1931**	**208**
Jan. 1,	1931	194.48	December,	1930	192
Feb. 1,	1930	206.46	January,	1930	199
Average,	1930	202.85	Average,	1930	260
Average,	1929	207.02	Average,	1929	317
1913	.....	100.00	1913	.....	100

This Week's Contracts

Heavy construction contracts, reported by *Engineering News-Record* in the week of Feb. 19, with some comparisons, total as follows:

(In Thousands of Dollars)

	Feb. 19, 1931	Average of Last Four Weeks 1931	1930
Buildings:			
Industrial	$1,898	$3,161	$3,998
Other	19,032	16,505	20,967
Streets and roads..	6,240	9,668	8,171
Other eng. constr..	22,769	15,695	14,182
Total	$49,939	$45,029	$47,318
Total, all classes Jan. 1 to Feb. 19:			
1931	$380,821		
1930	377,994		

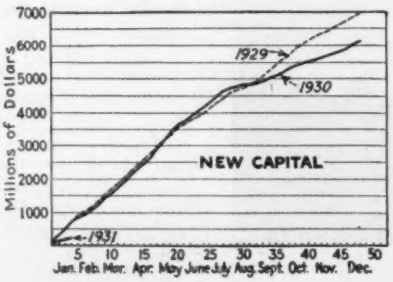
Material dug by the excavator and cleaned out by the bucket cleaner is broken up into small pieces which are comparatively easily compacted into a good embankment.

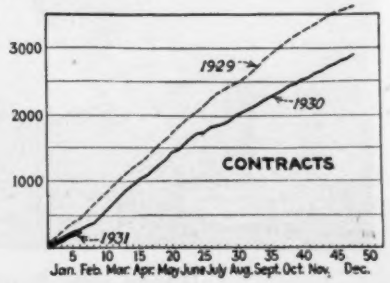
Mass Curves of Capital and Contracts

The accompanying charts give cumulative values of new capital and engineering construction for 1929-31. New capital figures include both net corporation securities and public bond sales and do not include investment trust, holding company or refunding paper.

The ratio of public bonds to total security volume is quite constant, averaging 35 per cent for capital and 39 per cent for contracts. For January, 1931, the percentages were 30 and 49, indicating chiefly a pronounced drop in private financing. Figures for the last three years and for January, 1929-31, are given in millions of dollars per average week in the following table.

	New Capital			Engineering Construction		
Year	Corporation	Public Bonds	Total Securities	Private	Public	Total
1928	72	41	113	42	27	69
1929	86	45	131	50	26	76
1930	78	42	120	34	27	61
Jan.						
1929	68	38	106	60	20	80
1930	83	40	123	27	21	48
1931	55	23	78	24	23	47





New Publications

Pulverizers—Details of construction and operation of the new type B pulverizer are described in detail and illustrated in bulletin 5-80 of the FULLER LEHIGH CO., Fullerton, Pa.

Wrought Iron—Details of the process used in the mechanical production of wrought iron as developed by the A. M. BYERS CO., Pittsburgh, Pa., are given in detail in a 22-p. illustrated booklet published by this company.

Ash Storage — UNITED CONVEYOR CORP., Old Colony Building, Chicago, Ill., has published a 16-p. illustrated bulletin on the subject of vitrified glazed tile ash-storage tanks.

Gasoline Locomotives—Industrial locomotives powered with McCormick-Deering units, including engine, clutch and transmission, in sizes ranging from 4 to 12 tons are described in a 12-p. illustrated booklet of the BROOKVILLE LOCOMOTIVE CO., Brookville, Pa.

Tractors—Design details of the new Case industrial tractors are described and illustrated in considerable detail in a 16-p. bulletin of the J. I. CASE CO., Racine, Wis.

Business Notes

KENNEDY VALVE MFG. CO. has appointed John J. Foy as its southern California representative, with headquarters at Los Angeles, and Harvey Embry its representative in Detroit and the lower Michigan peninsula.

DOMINION BRIDGE CO., Montreal, Canada, has entered into an agreement with the Steel Pipe & Line Co. (Hume's), Ltd., of Australia, to form the Hume Pipe Co. (Canada), Ltd., for the manufacture of plain and reinforced concrete, steel and other varieties of pipe under Hume patents.

PACIFIC ELECTRIC MFG. CO., San Francisco, Calif., has appointed Roy Wilkins vice-president in charge of engineering. Mr. Wilkins was associated for fifteen years with the Pacific Gas & Electric Co., and at the time of his resignation was assistant engineer in the division of hydroelectric and transmission engineering.

WOODBURY & WHEELER CO., Portland, Ore., has been appointed distributor of the complete line of welding equipment manufactured by the Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

CLEVELAND PNEUMATIC TOOL CO., Cleveland, Ohio, has elected Claus Greve chairman of the board; L. W. Greve, president; and John DeMooy, treasurer.

MARLOW PUMP CO., Ridgewood, N. J., has appointed as factory representative J. W. McCartney, formerly New York manager for the Cooper-Bessemer Co., Grove City, Pa.

CAMPBELL INDUSTRIAL WINDOW CO., New York City, has transferred E. F. O'Brien, Jr., chief engineer, to Washington, D. C., where his services as a consultant on the design, construction and operation of all types of windows are available to architects and contractors. Mr. O'Brien will be located at the Investment Building, 15th and K Sts., N. W.

HYDRAUGER CORP., LTD., San Francisco, Calif., has appointed W. A. Kohlhoff sales engineer. Mr. Kohlhoff was formerly with the gas engineering department of the Pacific Gas & Electric Co.

NORTHWEST ENGINEERING CO., Chicago, Ill., announces the appointment of Chester Coulter as district manager in the Pacific Northwest. Mr. Coulter, who will make his headquarters at 818 First Ave. South, Seattle, Wash., was formerly connected with the Erie Steam Shovel Co. and the Bucyrus-Erie Co.

Current Construction Unit Prices

Similar Reservoir Contracts Awarded Two Years Apart

PRICES are given herewith of two almost identical filtered water reservoirs at Springwells Station, Detroit, let respectively in January, 1929 (for No. 1), and December, 1930 (for No. 2). Arthur B. Morrill, assistant engineer of filtration for the city, states that the conditions of work on the two jobs were so similar that the prices furnish a fair indication of present costs compared with costs of two years ago. The prices then were thought to be so low as not likely to be equaled again; the same is felt of the prices received last December. Present costs, according to these data, are 18.5 per cent lower than at the beginning of 1929.

"In each case," says Mr. Morrill, "care was given to the preparation of plans and specifications to eliminate as far as possible uncertainties which would affect the contractors' cost; for example, this department assumed all responsibility as to the length of piles to be purchased and driven. The plans were so definite that there was very little change during construction, the total amount of extra work being about 1½ per cent. The second reservoir is immediately adjacent to the first and has one wall in common. On this account the quantities of excavation, concrete, etc., for the second are smaller than for the first, but the nature of the work is strictly comparable." A comparison of the unit price items common to both jobs was published in *Engineering News-Record*, Jan. 29, p. 194.

Unit prices are given of the lowest three bids on each job. The contractors were: No. 1 reservoir in 1929, A, W. E. Wood Co., 1805 Ford Bldg. (contract); B. Bryant & Detwiler Co., 2336 Dime Bank Bldg.; C, Spencer, White & Prentis Co., 1200 Washington Blvd. Bldg. No. 2 reservoir in 1930, A, Bryant & Detwiler Co. (contract); B, A. A. Alexander & Repass Bros.; C, W. E. Wood Co.

Reservoir No. 1:	A Quantity	A Unit Price	B Quantity	B Unit Price	C Quantity	C Unit Price
Earth excav. and backfill, cu.yd.	21,300	$0.85	19,910	$1.10	151,000	$0.65
Earth excav. hauled away, cu.yd.	124,300	.90	125,398	.71½	.....	.....
Earth excav. placed on site, cu.yd.	10,000	.55	10,000	.49½	10,000	.45
Timber piling (40 ft. nominal length piles) lin.ft.	181,760	.40	181,760	.35	181,760	.35
Reinf. conc. class A, cu.yd.	6,540	11.20	6,800	13.58	.....	.....
Reinf. conc., class B, cu.yd.	820	10.90	726	14.00	19,130	12.50
Reinf. conc., class C, cu.yd.	11,500	10.80	11,400	9.584	.....	.....
Reinforcing steel in place, lb.	2,200,000	.03½	2,200,000	.039	2,270,000	.04
Special castings, lb.	56,000	.11	52,000	.094	56,000	.08
Miscellaneous steel and iron, lb.	18,500	.16	10,000	.21	18,500	.20
Placing gates, valves, etc., (furn. by the city, lump sum)	.....	1,300.00	.....	1,386.00	.....	3,000.00
12 in. c.-i. belt drain (laying only), lin.ft.	1,135	1.50	1,134	.294	1,135	2.00
12 in. drain., lin.ft.	500	1.25	1,040	.825	800	1.00
6 in. drain., lin.ft.	14,500	.50	14,432	.583	15,000	.30
Crushed limestone or gravel, cu.yd.	3,000	3.00	3,006	3.63	3,000	3.00
12 in. c.-i. sewer, lin.ft.	500	10.00	500	8.40	500	4.00
Miscellaneous (lump sum)	.....	1,000.00	.....	20,757.00	.....	18,200.00
Engineer's field office	.....	4,000.00	.....	2,000.00	.....	3,000.00
Cleaning up (lump sum)	.....	1,500.00	.....	1,000.00	.....	1,000.00
Contract bond, insurance, etc.	.....	12,000.00	.....	5,500.00	.....	8,000.00
Hand excavating	.....	8,000.00	.....	.....	.....	.....
Totals	.....	$538,500	.....	$547,700	.....	$556,141

Reservoir No. 2	A Quantity	A Unit Price	B Quantity	B Unit Price	C Quantity	C Unit Price
Earth excav. and backfill, cu.yd. / Earth excav. placed on site, cu.yd.	97,000	$0.49*	15,000 / 82,000	$0.44 / .44	93,000	$0.685
Timber piling (40 ft. nominal length piles), lin.ft.	150,520	.325*	150,520	.35	150,520	.35
Reinf. conc., class A, cu.yd.	6,600	10.28*	5,700	10.50	6,220	12.00
Reinf. conc., class B, cu.yd.	10,300	9.76*	385	10.50	350	8.00
Reinf. conc., class C, cu.yd.			10,315	10.50	10,073	8.00
Reinforcing steel in place, lb.	1,900,000	.0244*	1,920,000	.027	1,900,000	.025
Special castings, lb.	22,000	.08½*	22,000	.10	26,800	.08
Miscellaneous steel and iron, lb.	4,000	.24*	8,400	.13	6,400	.15
Placing valves, pipe, etc. (furn. by the city), lump sum	.....	424.00	.....	500.00	.....	744.00
12 in. c.-i. belt drain (laying only), lin.ft.	590	.36*	600	1.10	590	1.50
12 in. vitrified drain, lin.ft.	600	.70	600	.70	600	.78
6 in. vitrified drain, lin.ft.	13,630	.35	13,000	.30	13,800	.43
Crushed limestone or gravel, cu.yd.	3,000	2.24*	3,400	2.50	2,800	2.30
12 in. c.-i. sewer, lin.ft.	120	2.86*	120	1.00	120	1.40
16 in. c.-i. sewer, lin.ft.	310	3.49*	310	1.00	310	1.80
20 in. c.-i. sewer, lin.ft.	420	4.08*	420	2.00	420	4.20
Miscellaneous (lump sum)		1,500.00		2,500.00		3,000.00
Cleaning up (lump sum)		1,000.00		1,000.00		1,000.00
Contract bond, insurance, etc.		3,400.00		7,700.00		7,300.00
Totals		$335,582		$349,144		$353,276

*All figures are copied from proposals. This unit price does not give exact amount stated.

Highway Bridge Over Wabash River Between Illinois and Indiana

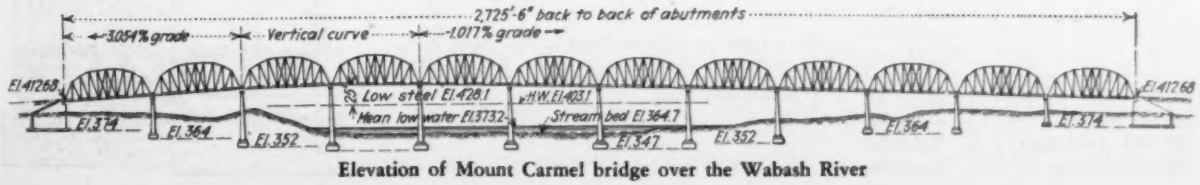
ILLINOIS division of highways will build a bridge over the Wabash River at Mount Carmel consisting of twelve identical steel trusses each 225 ft. long. Piers and abutments are of reinforced concrete and are supported by untreated wood piles. The over-all length of the bridge is 2,725½ ft. back to back of abutments and the roadway is 23 ft. wide. Clearances are 54¾ ft. above mean low water and 63¼ ft. above streambed; high water was 39¼ ft. deep in 1913.

The difference between the two classes of concrete is in gradation of the course aggregate:

Sieve	Per Cent Passing A	Per Cent Passing X
2-in.	100	.....
1-in.	45@90	100
½-in.	25@70	.....
¼-in.	10@30	20@50
No. 4	0@5	0@5

Twenty-three bids were received Dec. 9, 1930; contract

	Steel Superstructure	Piers	Abutments	Total	A	B	C
Class A concrete, cu.yd.	.....	9,913.3	.....	9,913.3	$11.25	$17.75	$18.66
Class X concrete, cu.yd.	1,303.3	.....	1,111.7	2,415	10.85	19.00	17.55
Reinforcing bars, lb.	194,970	97,320	115,180	407,470	.0325	.04	.033
Structural steel, lb.	5,379,820	.....	.....	5,379,820	.044	.048	.04944
Untreated piling, 30 ft. long, lin.ft.	.....	42,360	5,940	48,300	.15	.15	.155
Untreated piling, 20 ft. long, lin.ft.	.....	.....	3,960	3,960	.15	.15	.155
Steel castings, lb.	87,100	.....	.....	.....	.072	.084	.0595



Elevation of Mount Carmel bridge over the Wabash River

was awarded to the Vincennes Bridge Co., Vincennes, for a price 20 per cent below that of the next bidder and 31 per cent below the average. Unit prices are given of the lowest three bidders: A, Vincennes Bridge Co., $399,414; B, Koss Construction Co., $499,492; C, Whiting-Turner Construction Co., $509,899. G. F. Burch is bridge engineer, division of highways.

Grading Road in Oregon

BUREAU of Public Roads, Dist. No. 1, Portland, Ore., opened bids on Jan. 6 for grading 4.285 miles of the Roosevelt Coast Highway, 18 ft. wide, in Douglas and Lane counties. Lowest three bidders are: A, Fred H. Slate, Portland, (awarded contract); B. Morrison-Knudsen Co., Boise; C, A. C. Greenwood, Portland.

	A	B	C
50 acres clearing	$350.00	$325.00	$300.00
35 acres grubbing	250.00	500.00	300.00
325,000 cu.yd. unclass. excav.	.27	.24	.31
1,200 cu.yd. unclass. excav. for structures	1.00	.75	1.50
5,000 cu.yd. unclass. excav. for borrow	.30	.25	.40
350,000 st.yd. overhaul	.02	.01	.02
4.285 miles finishing earth-graded road	200.00	300.00	300.00
70 dangerous trees and snags	15.00	15.00	20.00
15 acres sand slope protection, type 1	150.00	500.00	300.00
8 acres sand slope protection, type 2	200.00	450.00	400.00
210 cu.yd. class A conc. (box gulvert)	30.00	35.00	30.00
2,000 lin.ft. wood gutter	.40	.50	.50
21,000 lb. reinf. steel	.08	.07	.07
1,300 lin.ft. 18-in. reinf. conc. pipe in place	3.00	3.00	3.00
130 lin.ft. 24-in. reinf. conc. pipe in place	4.00	4.00	5.00
65 lin.ft. 30-in. reinf. conc. pipe in place	6.00	6.00	7.00
500 cu.yd. loose riprap in place	2.00	1.50	2.00
1,000 lin.ft. 6-in. porous tile underdrain	.50	.60	.50
140 lin.ft. 18-in. double str. reinf. conc. pipe	4.00	3.50	4.00
270 lin.ft. 24-in. double str. reinf. conc. pipe	4.60	5.00	6.00
75 lin.ft. 30-in. double str. reinf. conc. pipe	7.00	7.00	9.00
Totals	$146.874	$149,181	$165,566

New Swing Span Over Neuse River at Newbern, N. C.

NORTH CAROLINA highway commission is replacing a drawbridge over the Neuse River at Newbern, N. C., built in 1921 with a new swing span 158 ft. long, including pivot and rest piers, fender work and electrical equipment. Streambed to top of cap is 29 ft. The existing bridge, including swing span, three approach spans, fenders, pivot piers, rest piers and approach span piers, will be removed. Both highway and river traffic must be maintained by means of a timber pile trestle, with one movable span, having a roadway of 12 ft.

Layout and elevation are shown in the drawing. The bill of material includes the following: Each of the two piers, 26.6 cu.yd. concrete, 1,440 lb. reinforcing, 12 precast piles; pivot pier, 134.7 cu.yd. concrete, 6,386 lb. reinforcing, 27 piles; swing span, 15 tons machinery, 10.575 tons structural steel. Concrete for caps of pivot pier and rest piers is class A, 1:2:4. Precast piles are made of 1:1½:3. Type of swing span is steel truss, center bearing, with balancing wheels and tracks, center and end wedges and full circle rack. Time to open, 9 minutes for hand operation, and 2½ minutes for mechanical operation.

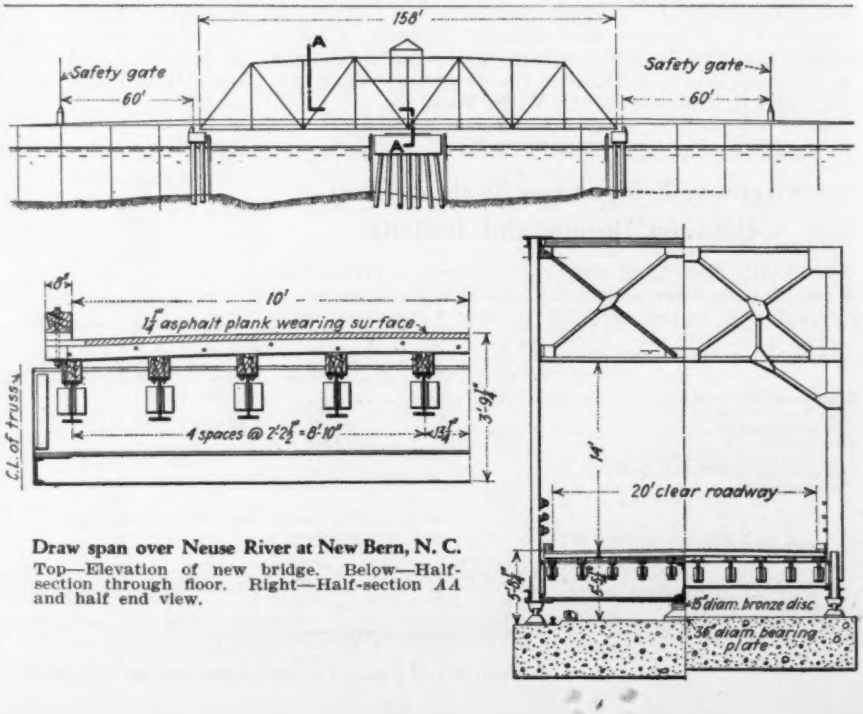
Seven bids were received Dec. 9, 1930, and unit prices are given of the lowest three: A, bridge maintenance department, highway commission, Raleigh, $65,375; B, Austin Bros. Bridge Co., Atlanta, $71,465 (contract); C, Roanoke Iron & Bridge Works, Roanoke, Va., $72,284. W. L. Craven is bridge engineer for the North Carolina commission.

	A	B	C
188 cu.yd. class A conc.	$25.00	$25.00	$37.00
37,300 lb. rein. steel	.05	.05	.04
8,280 lin.ft. creo. tim. piling	1.15	1.50	.80
214,500 lb. structural steel	.06	.06	.077
74.5 M. ft. B.M. creo. str. tim.	100.00	110.00	150.00
345 sq.yd. asph. wear. surf.	2.00	2.00	3.00
3 unloaded test piles	200.00	250.00	100.00
Electrical equipment (lump sum)	7,350.00	7,450.00	7,800.00
Operator's house (lump sum)	1,000.00	690.00	3,500.00
Safety gates (lump sum)	1,500.00	600.00	1,000.00
30,000 lb. of machinery	.25	.25	.30
2,295 lin.ft. pre-cast conc. piling	4.50	5.00	3.00
Totals	$65,375	$71,465	$72,284

Street Improvement in Tulsa, Okla.

BOARD of commissioners, Tulsa, Okla., opened bids Dec. 12, 1930, for paving, grading, draining and curbing a street 26 ft. wide in Improvement Dist. No. 1055. Three bids were received and contract was let to (A) Calumet Construction Co., 840 East Apache St., for $34,305. Other bidders were (B), Standard Paving Co. and (C) H. L. Cannady Co., both of Tulsa.

	A	B	C
7,733.2 sq.yd. class F—7-in. paving	$2.15	$2.12	$2.13
4,807.6 lin.ft. 7x10x18-in. curb, 1:2:3 mix	.80	.78	.78
252.0 lin.ft. headerboard	.40	.40	.40
2,664.2 cu.yd. excav. and borrow	.65	.70	.70
372.8 cu.yd. solid rock excav.	3.00	3.00	3.00
1,373.0 lin.ft. ½-in. expansion joint	.15	.15	.15
2,919.5 lin.ft. metal center joint	.25	.25	.25
7,784.3 sq.yd. fine grading	.10	.09	.10
Drainage for District			
41.5 cu.yd. conc., 1:2:4 mix, for retaining walls	14.00	14.00	14.00
3,485.0 lb. reinf. steel for retaining walls, ½-in. bars	.04	.04	.04
157.0 cu.yd. unclass. excav. for retaining walls	1.00	1.00	1.00
1,044.0 lin.ft. 15-in. storm tile	1.25	1.35	1.35
300.0 lin.ft. 18-in. storm tile	1.45	1.55	1.55
417.0 lin.ft. 21-in. storm tile	1.85	1.95	1.95
645.0 lin.ft. 24-in. storm tile	2.30	2.40	2.40
180.0 lin.ft. 30-in. storm tile	3.35	3.45	3.45
555.0 cu.yd. earth excav.	.75	.75	.75
188.0 cu.yd. loose rock excav.	1.75	1.75	1.75
539.0 cu.yd. solid rock excav.	2.75	2.95	3.00
6.0 standard manholes, 6 ft. deep	50.00	55.00	55.00
1.0 additional foot of manhole	5.00	5.00	5.00
6.0 manholes to grade, using old castings	10.00	10.00	10.00
12.0 single grating catch basins	50.00	55.00	55.00
7.0 double grating catch basins	60.00	65.00	65.00
2.0 sewer connections	10.00	10.00	10.00
4.0 standard concrete headwalls, for 15, 21, 24 and 30 in.	15.00	15.00	15.00
Totals	$34,305	$34,524	$34,706



Draw span over Neuse River at New Bern, N. C.
Top—Elevation of new bridge. Below—Half-section through floor. Right—Half-section *AA* and half end view.

CONSTRUCTION NEWS

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Some of the Week's Large Projects

Location	*Project*	*Cost*	*Status*
Waterworks			
Danbury (Conn.)	Reservoir, etc.	$1,000,000	Proposed
Sewers			
Chicago	Sewers	$3,598,000	Bids asked
Excav. Dredging			
Brownwood (Tex.)	Irrigation	$6,000,000	Proposed
Railways			
New Jersey	Railway	$1,763,284	Contract
Canada	Railway	1,000,000	Contract
Grade Crossings			
Dayton (O.)	Grade Crossings	2,500,000	Proposed
Grain Elevators			
Kansas City (Mo.)	Grain Elevator	1,000,000	Bids asked
Sports and Parks			
Toronto (Ont.)	Sports Arena	1,250,000	Proposed
Unclassified			
Toledo	Asphalt plant	1,000,000	Proposed
Oklahoma	Gas pipe line	11,000,000	Contract
Baker (Ore.)	Gas pipe line	1,000,000	Proposed
Memphis	Terminal	1,000,000	Proposed
Montreal (Que.)	Tunnel	2,556,000	Contract
Fed. Govt.			
Boston	Post office	6,000,000	Bids asked
New York	Federal Court	8,000,000	Proposed
Factories and Mills			
New Castle (Del.)	Steel plant	1,000,000	Proposed
Cleveland	Wire mill	1,000,000	Contract
Power Plants			
Tulare (Calif.)	Light plant	3,000,000	Proposed
Eagle Pass (Tex.)	Hydro-electric plant	1,500,000	Proposed
Buildings			
New York	Apartment	1,250,000	Contract
New York	Church	3,450,000	Contract
Holmdel (N. J.)	Hospital	1,000,000	Proposed
Jersey City	Hospital	1,000,000	Proposed
New York	Office	1,500,000	Proposed
New York	Office	1,200,000	Bids asked
Quincy (Ill.)	School	1,300,000	Bids asked
New York	High School	2,500,000	Proposed
Rochester (N. Y.)	Divinity School	1,000,000	Contract
Cleveland	Department store	1,000,000	Contract
Indianapolis	Telephone exchange	1,000,000	Contract

WATERWORKS

PROPOSED WORK

Calif., San Bernardino — County Waterworks Dist. 9, distribution system. $45,000.

Conn., Danbury—City, reservoir, incl. dam, filter beds, c.i. pipe, etc. $1,000,000. Hazen & Everett, 25 West 43rd St., New York, engrs.

Conn., Terryville—Terryville Water Co., Town Hall, Main St., mains from Town Hall Reservoir to village of Plymouth. $40,000.

Conn., Willimantic—City filtration plant. To exceed $15,000. A. Collins, city engr.

Ill., Chicago—City ordinance to issue bonds for waterworks improvements, incl. improvements at William Hale Thompson Pumping Station $48,000; Mayfair Pumping Station $389,500; distribution system $500,000; laying mains for fire protection $343,000; mains for water main betterments $140,000; mains for street widening $300,000; mains for subway construction $285,000; meter and meter connections $611,000; purchase and installation of meters $383,000. P. H. Smith, city clk.

Ind., Newcastle — Remodeling waterworks plant, incl. new basin. $20,000.

Ky., Lawrenceburg—City will not construct pipe line to Kentucky River. Project abandoned. H. K. Bell, Lexington, engr. Noted Jan. 1.

Mass., Burlington — Town, Bd. Selectmen, water supply. To exceed $15,000.

Mass., Southampton—Town, watermains, constructing 100,000 gal. standpipe to connect with Holyoke supply. To exceed $15,000. C. L. Lyman, chn. com.

N. H., Nashua—Penichuck Waterworks Co., Nashua, retained Metcalf & Eddy, engrs., Statler Bldg., Boston, Mass., to study present condition of its works. This corrects report in Jan. 29 issue.

N. C., Charlotte—Watermain from city lines to county industrial home, incl. 31,700 ft. 8 in. pipe. $37,180-$52,800.

O., East Cleveland (br. Cleveland) — City, steel plate water storage tank. $25,000. M. Garnett, 14320 Euclid Ave., engr.

Okla., Chickasha—Waterworks improvements, $190,000 bonds voted. R. O. Bradley, Chickasha, engr. Noted Feb. 12.

S. D., Martin — Waterworks, $32,800 bonds authorized. Dakota Eng. Co., Mitchell, engrs.

Tex., Corpus Christi—c/o P. G. Lovenskiold, mayor, repairing damaged municipal waterworks dam at Lake Lokenskiold, $110,000; new construction to replace damaged parts, $300,000. H. E. Elrod, Corpus Christi, and R. J. Cummins, Bankers Mortgage Bldg., Houston, engr.

Ont., Chatham — Waterworks improvements, incl. 2 new electric pumps, apparatus for thawing out hydrants, new valves, new hydrants and either reservoir or water tank. $35,000. T. M. S. Kingston, City Hall, engr.

Ont., Fort Erie—Town, 350,000 imperial gal. steel waterworks tank, concrete found., on Bertie St., connecting c.i. mains, $38,500. Ontario Engr. Co., Fort Erie, engrs.

Ont., Ottawa—City purchasing, installing 1,000 waterworks service meters. $15,000. W. E. MacDonald, city engr.

Ont., Ottawa—Nepean Twp., pumping station, electrically driven centrifugal pumps, valves, piping, etc., Pontiac Rd. $35,000. James, Proctor & Redfern, 36 Toronto St., Toronto, engrs.

BIDS ASKED

Calif., Orange — Feb. 26, by Bd. Directors Serrano Irrigation Dist., earth fill dam, 125 ft. high with concrete spillway providing 25,000 acre ft. storage reservoir, for Serrano Irrigation Dist., Capenter Water Co. and Irving Co. A. Kempkey, Hobart Bldg., San Francisco, engr.

Conn., Hartford — City, Engineers Dpt., City Hall, bids about Mar. 10, pumping station South Meadows, also sewerage conduit through dike and pressure relief wells at foot of Warwarme Ave. To exceed $25,000. R. N. Clark, City Hall, engr. Noted Nov. 13.

Ill., Western Springs—Feb. 25, by Village, iron removal and water softening plants. $80,000. Alvord, Burdick & Howson, 20 North Wacker Dr., engrs. Noted Oct. 1.

Ind., Ft. Wayne—Feb. 24, by Bd. P. Wks., City Hall, St. Marys River Feeder Main, 24 in. c.i. pipe. $100,000.

Ia., Burlington—Mar. 4, by Citizens Water Co., F. Lowler, supt., B-steel standpipe. Alvord, Burdick & Howson, 1401 Civic Opera Bldg., Chicago, Ill., engrs.; adv. E. N.-R. Feb. 19.

Me., Portland—Mar. 2, by Trustees Portland Water Dist., two 5 m.g. pumps with gasoline engines. $40,000. H. U. Fuller, 16 Casco St., engr.

Mass., Springfield — Mar. 9, by Bd. Water Comrs. Springfield Municipal Waterworks, H. M. King, supt., 1,800 lengths Class E, 4- to 12-in. c.i. water pipe, price per ton of 2,000 lb. freight allowed Armory for each size of pipe; 75 eight in. B.B. valves and seventy 4, 6 and 8 in. B. and F. valves, price per valve delivered, freight allowed, Armory; corporations, inverted key curb cocks, inverted key stop and waste cocks with special handles, etc., prices, freight allowed, Armory; adv. E. N.-R. Feb. 19.

Mo., St. Louis—Feb. 23, by N. L. Meston, supply comr., 7,000 ft. 16 and 20 in. c.i. water pipe. L. Day, water comr.

Neb., Hastings—Feb. 23, by A. T. Bratton, clk., 8 and 10 in. c.i. pipe in Water Dist. G. $30,000. P. T. Naylor, city engr.

N. J., Elizabeth—Feb. 24, by Bd. P. Wks., City Hall, 7,000 ft. 30 in. cement lined c.i. supply main. T. Collins, city engr.; adv. E. N.-R. Feb. 19.

N. Y., Brooklyn—Feb. 20, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., mains in Krier Pl., Linden Blvd., Remsen Ave., 54th, 56th, 58th, 59th 97th and East 37th Sts.

N. Y., New York—Feb. 20, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., mains in St. Ouen and East 215th Sts., Barnes, Bronxwood, Cranford, Fish, Goulden, Harper, Laconia, Matthews, Morris Park, Pearsall, Radcliffe, and Wilder Aves., Bronx Boro.

S. D., Huron—Mar. 24, by City Clerk, 300,000 gal. elevated steel water tank. O. A. Ricker, city engr.

Tenn., Nashville—Feb. 24, at office S. H. McKay, city clk., electric, motor driven pumping unit for pumping station, f.o.b. Nashville. H. E. Howse, mayor.

Tex., Wharton—Feb. 23, at office City Secretary, waterworks improvements, incl. well, pump and motor and pump house, tank foundations, steel tank and tower, 300,000 gal. or more capacity. J. C. McVea, 426 Esperson Bldg., Houston, engr.

CONTRACTS AWARDED

Ia., Burlington—Citizens Water Co., F. D. Lawler, supt., 2,400 ft. 12 in. c.i. water pipe, to Amer. Cast Iron Pipe Co., 2930 North 16th St., Birmingham, Ala.; centrifugal pumps, to American Well Wks., 110 North Bway., Aurora, Ill.; laying pipe, own forces. Private plans. Noted Sept. 25.

Ia., Winterset—Installing collecting well 35 ft. deep, 30 ft. diam., pump pit, resetting centrifugal service pump, to E. L. Royer Constr. Co., Valley Junction, $15,480.

See proposal advertising on page 104

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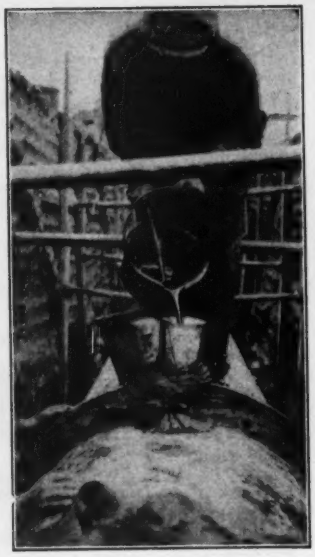
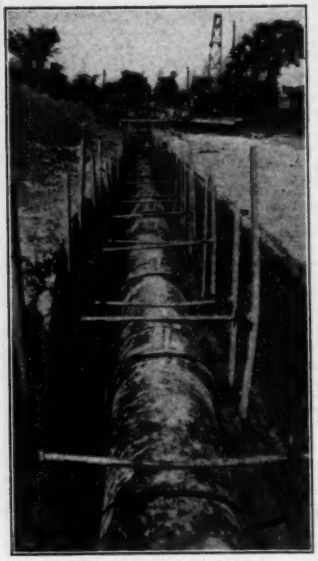
LEADITE

Trade Mark Registered U.S. Pat. Office

Lowering Pipe in Trench



Pouring 36" Leadite Joint



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Tested and used for over 30 years.
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Land Title Building - - - Philadelphia, Pa.

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Waterworks (Continued)

Kan., Augusta—City Council, flow line and low service pumping station, Sect. 1, to W. B. Carter, 7 North Rockford St., Tulsa, Okla., $30,435.

Massachusetts—Metropolitan Dist. Comn., 20 Somerset St., Boston, furnishing, laying 7,700 lin.ft. 60 in. steel water pipe between Boston and Newton, to C. & R. Constr. Co., 75 Bradeen St., Roslindale, $150,962.

Mich., Detroit—Dpt. Water Supply, furnishing filter underdrain pipe, castings for new filtration plant, to McWane Cast Iron Pipe Co., 3700 11th Ave. N., Birmingham, Ala., $44,877; 300 lengths 6 in. Class B c.i. water for Fire Dpt., f.o.b. Detroit, to Crane Co., 150 Randolph St., at $42.10 per ton.

Mich., Detroit — Dpt. Water Supply, 735 Randolph St., 6 traveling water cranes for installation in Springwells Station, to Link Belt Co., Pershing Rd., Chicago, Ill., $36,857.

Mich., Detroit — Bd. Water Comrs., 735 Randolph St., G. H. Fenkel, genl. mgr., rein.-con. stone, steel chemical building at Springwells Station, to W. E. Wood Co., Union Trust Bldg., $173,785. Noted Jan. 22.

Miss., Laurel—City Council, to Amer. Cast Iron Pipe Co., 2930 North 16th St., Birmingham, Ala., 9,000 ft. 12 in. Mono cast B and S pipe at $1.38 per ft., 1,000 ft. 10 in. $1.07, 1,000 ft. 8 in. $0.80, 1,000 ft. 6 in. $0.56, standard fittings $104 net ton at prices f.o.b. foundry, full freight allowed to Laurel; to Dixie Supply Co., New Orleans, La., 10 fire hydrants at $64.15 each, oiled jute $9 per cwt.; to Laurel Machine Co. & Fdry. Co., Laurel, 8,000 lb. pig lead, $6.25 per cwt. Noted Jan. 22.

N. Y., Long Island City—J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, mains in 27th Ave., to Knidem Constr. Co., 4197 Park Ave., New York, $2,249; in Elliott Pl., to S. Gallucci, Railroad Ave., $7,941. Noted Jan. 29.

O., Cleveland Heights — For 1 m.g. water storage tank and 10,000 gal. pressure tank, to Youngstown Tank & Boiler Co., 2021 Prospect Ave., Cleveland, $16,500; footings, to P. H. DeSantis, 12510 Britton Rd., Cleveland, $2,370. Noted Jan. 22.

Tex., La Feria — City, c/o L. R. Beddoes, waterworks, sewer extensions, paving streets, to F. P. McElwrath, Corsicana, $30,000. Noted Nov. 20, under "Sewers."

Tex., Yoakum — City, c/o E. S. Winfree, mayor, complete waterworks, incl. 158,374 ft. 2- to 10-in. c.i. pipe, 2 ten-in., 30 eight-in., 127 six-in., 140 two-in. gate valves, 188 fire hydrants, 1 concrete reservoir, one 300,000 gal. elevated tank, 1 pumping station, 2 deep well pumps, 2 booster pumps, 1,000 meters and boxes, 20,000 lin.ft. copper services; 1 trapping machine, to Kirkwood, Wharton & Lee, 518 North Flores St., San Antonio, $258,392. Noted Jan. 29.

Wash., Seattle—Water Dist. 38, waterworks, incl. 6 mi. 1- to 6-in. galvanized mains, to A. Del Guzzo, 3702 West Ida St., $41,670.

Ont., Thessalon—Town, general contract concrete control dam on Little Thessalon River, near here, to G. P. Sandie, Thessalon; steel pipe, to Horton Steel Wks., Bridgeburg; valves, to General Supply Co. of Canada, 34 Toronto St., Toronto. Est. $25,000. Noted Jan. 22.

Ont., Toronto—Scarboro Twp., 2 mi. 6- to 10-in. c.i. mains with valves, hydrants, in Kitchener Park Dist., day labor. $34,000. R. Harrison, 1664 Kingston Rd., engr.

SEWERS

PROPOSED WORK

Calif., San Francisco — City Council, sewers, manholes in Golden Gates Heights, to exceed $25,000; 884 ft. 7 ft. 3 in. x 9 ft. rein.-con. sewer, 380 ft. 5 ft. 6 in. circular rein.-con. sewer in Sunset Blvd. at Lincoln Way. M. M. O'Shaughnessy, city engr.

Calif., Santa Clara—City purchased 236 acre site for sewer farm-treatment plant. $100,000.

Conn., Hartford—State sewerage system, incl. filter beds at Cedarcrest Sanatorium. $50,000. Engineer not selected.

Conn., Winsted—Town preliminary plans sewage disposal plant. To exceed $25,000. G. W. Knight, Town Hall, engr.

Ill., West Frankfort—Sewerage system, disposal plant. $383,000. Project postponed indefinitely. Noted Jan. 1.

Ind., Auburn—City Council, trunk line sewer, disposal plant. $65,000. P. Holman, Auburn, engr.

Ind., Seymour—City bids during March, 14,155 ft. 24- to 48-in. rein.-con. storm and sanitary sewers in 3rd and Laurel Sts. $80,000.

Ia., Cedar Rapids — City Council soon takes bids West Side Sanitary sewers, sewage pumping station. $150,000. P. E. Young, City Hall, engr. Noted May 22.

Mass., Manchester — Town, Bd. Selectmen, sewerage and waterworks improvements. $28,500 appropriated.

Mass., Marblehead—Town, Bd. Selectmen, extending sewerage system. To exceed $25,000.

O., Cleveland — City survey to determine needs sewage disposal plant, White City at East 140th St. $14,000,000. G. B. Gascoigne, Leader Bldg., engr. Noted Nov. 13.

Ont., Crystal Beach — Town enlarging, improving rein.-con. sewage disposal plant. $25,000. E. H. Darling, 36 James St. S., Hamilton, engr.

BIDS ASKED

Calif., Oceanside—Feb. 25, by City Council, storm water drain in 1st St., (a) furnishing pipe at trenchside 12 ft. 12 in., 402 ft. 18 in. and 296 ft. 20 in. cement pipe (b) furnishing equipment and labor (city furnishing pipe) (c) project complete.

Ill., Chicago—Feb. 24, by City, at office Bd. Local Impvts., City Hall, system of brick, tile sewers, brick manholes, catch-basins in Jonquil Terrace, 1 alley, Pratt and Ashland Blvds., Magnolia, Glenwood, North Ashland, Birchwood, Balmoral, Thorndale, Albion, Wayne, Morse and Sherwin Aves.; drains in West 53rd Pl., West 54th St., South Sawyer, South Spaulding, South Turner, South Homan, North Sacramento, South Keating, South Kilpatrick, South Knox, South LaCrosse, South Lamon, South Porte, South Levergne, South Latrobe, South Lockwood, South Lorel, South Long, Osceola, Olcott, Oleander, Oriole, South Wabash and South Michigan Aves. $3,598,000. M. J. Faherty, pres. Noted Jan. 29.

Ill., Chicago—Feb. 26, by J. J. Sullivan, clk. Sanitary Dist. of Chicago, 910 South Michigan Ave., delivering, installing bar type sewage screens and rakes at North Side Sewage Treatment Works, Howard Ave. and McCormick Blvd., Niles Center. R. A. Woodhull, chn.

Ky., Ft. Thomas—Mar. 3, at office City Engineer, sewage disposal plant; adv. E. N.-R. Feb. 19.

La., Lake Charles—Feb. 25, by City, 10,000 ft. 15 blocks sewer extensions, Ward 4.

Md., Baltimore — Feb. 25, by Bd. Awards, sanitary sewers in Sanitary Contr. 272 and Sanitary Contr. 267. M. J. Ruark, Municipal Bldg., sewerage engr.

Md., Baltimore—Mar. 2, by Bd. Awards, furnishing, laying vitr. sewer, appurtenances, incl. 42,710 lin.ft. 8- to 18-in. terra cotta sewer, and 10,275 lin.ft. 6 in. house connections in Leeds, Arbutus and Ridgewood Sts. B. L. Crozier, Court House, Towson, ch. engr.

Minn., Marshall — Mar. 6, by City, sewage disposal plant, incl. Imhoff tank, rock filters. $49,900. W. E. Buell & Co., Insurance Exch., Sioux City, Ia., engrs. Noted Dec. 11.

Mo., St. Louis—Taking bids reconstructing, repairing Vandeventer Ave. Sewer. $34,292. W. W. Horner, 300 City Hall, engr.

Mo., St. Louis—Mar. 10, by Bd. P. Serv., City Hall, Sect. B, Blendon Place Public Relief Sewer, 2,080 ft. long built in tunnel 5 ft. plain concrete horseshoe, lateral service connections. $95,000. W. W. Horner, city engr.

Neb., Grand Island—Mar. 4, by H. E. Clifford, city clk., sewage disposal plant, incl. grit chamber, screen house, preliminary clarifier, aeration tanks, final clarifier sludge beds, pump and boiler house, 15,400 cu.yd. excav., 1,850 cu.yd. rein.-con. $130,000. Black & Veatch, 700 Mutual Bldg., Kansas City, Mo., engrs. This corrects report in Feb. 12 issue.

N. Y., Brooklyn—Feb. 25, by H. Hesterberg, pres. Brooklyn, Boro Hall, sewers in Linden Blvd., Miller and Stanley Aves., Vermont, Wyona, Bradford and East 48th Sts.

N. Y., Clinton—Mar. 10, at office Dpt. Correction, W. N. Thayer, Jr., comr., State Office Bldg., Albany, sewage disposal system, at Clinton Prison and Dannemora State Hospital; adv. E. N.-R. Feb. 19.

N. Y., New Rochelle — Feb. 27, by Westchester Co. Sanitary Sewer Comn., E. S. Martin, secy., Court House Annex, White Plains, 8,000 ft. 16 and 24 in. trunk sewer; adv. E. N.-R. Feb. 19.

N. Y., New York—Mar. 9, by Sanitary Comn., W. Schroeder, Jr., Municipal Bldg., constructing preliminary and final settling tanks, aeration tanks, substructures for operating galleries, preliminary and return sludge storage, and decantation tanks, with appurtenant pipes, conduits, drains and other accessories, Contr. B, Sect. 2, in connection with construction sewage treatment works on Wards Island. Noted Jan. 15.

N. C., Winston-Salem — See "Contracts Awarded."

O., Bellefontaine—Mar. 2, by Comrs. Logan Co., Indian Lake Sewerage System. W. A. Montgomery, engr.

Wis., Arcadia—Mar. 17, by R. N. Hohman, city clk., sewers, Option A, 30,936 ft. 8- to 15-in. sewer, 108 manholes, 6 in. house sewers, 1 sewage pumping station, 1 syphon, 1,400 cu.yd. borrow, 1 sewage plant, clarified pump, chamber, sludge digester and sludge bed; Option B, 34,809 lin.ft. 8- to 15-in. c.i. pipe, 120 manholes, 6 in. sewer house connections, 1 sewage pumping station, 1 syphon, 4,100 cu.yd. excav., 1 sewage plant, clarifier, pump chamber, sludge digester, sludge bed.

Que., Hull—See "Contracts Awarded."

CONTRACTS AWARDED

Mich., Detroit—Dpt. P. Wks., 1,657 ft. 4 ft. 9 in. concrete cylindrical sewer in tunnel, 5 manholes, air lock with 2 bulkhead doors, Sanders Ave. Arm extension in Sanders and Dix Aves. from Colonial to Mellon Aves., to Jos. Rossi & Sons, Inc., 24001 Seven Mile Rd., $42,703.

N. J., Newton—Town Comn., 115 Spring St., Newton, altering and extending Sparta and Clinton St. Sewage Disposal Plant, Sect. 1, to Merritt, Chapman & Scott Corp., 17 Battery Pl., New York, $89,800; Sect. 2, to Hitchings & Co., 701 Spring St., Elizabeth, $8,904; Sect. 3, to Gray Constr. Co., Franklin St., Morristown, $3,200. Grand total $101,904. Noted Feb. 5.

N. Y., Brooklyn—H. Hesterberg, pres. Brooklyn Boro, Boro Hall, sewers in West 12th St., to J. Pecone Contg. Co., 102-09 217th St., Hollis, $16,887; in East 52nd St., to E. Meluccio, 1209 61st St., $1,667; in Bway. and Grove Sts., to R. Iovino, 678 Glemore Ave., $162. Grand total $18,716. Noted Jan. 29.

N. C., Winston-Salem — City, sewer outfall, sewage pumping stations, pumping mains in Waughton suburb, $116,000, sewer extensions in various parts city., $10,000, own forces.

S. D., Arlington—For 20,700 ft. 7 and 12 in. sewer, to Gjellefald Constr. Co., Forest City, Ia., $22,940; sewage disposal plant, to Ellerman & McLain, Yankton, $11,838. Noted Jan. 22.

Tex., La Feria—See "Waterworks."

Que., Hull—New sewer in St. Joseph's Blvd., day labor. $135,000. T. Lanctot, City Hall, engr.

WASTE DISPOSAL

PROPOSED WORK

Conn., Manchester — Town, Bd. Health, garbage incinerator.

BIDS ASKED

D. C., Wash.—Mar. 17 (extended date), by District Comrs., constructing either of both of 2 municipal refuse incinerators, 170 tons and 425 tons daily capacity respectively; adv. E. N.-R. Feb. 19. Noted Jan. 29.

BRIDGES

PROPOSED WORK

Mass., Boston—City, Dept. P. Wks., rein.-con., steel bridge over Boston & Albany R.R. and New York, New Haven & Hartford R.R. tracks, Arlington St. $150,000. J. E. Carty, Dpt. P. Wks., engr.

Mass., Manchester — Town, Bd. Selectmen, bridges, hys. and improvements. $28,000 appropriated.

Mass., Palmer—Town, Bd. Selectmen, concrete bridge to replace present one at Whipple St. $25,000.

Mass., Yarmouth—Town, Bd. Selectmen, C. R. Bassett, concrete bridge over Run Creek, near Bass River.

Miss., Columbus—State Hy. Comn., Jackson, soon takes bids concrete, steel bridge over Buttahatchie River, on Columbus-Aberdeen Rd. near here. G. A. Draper, c/o owner, engr.

N. J., Red Bank—Bd. Freeholders Monmouth Co., Court House, preliminary plans 50 ft. span hy. bridge over railroad extension of Shrewsbury Ave. to connect with Eatontown Hy. $25,000 or more. G. K. Allen, 60 Broad St., co. engr.

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., bids about March, bridge to carry Sunrise Hy. over Rockaway Blvd. $215,000.

N. Y., Marathon—Dpt. P. Wks., A. W. Brandt, comr. Hys., Albany, 175 ft. steel truss bridge, 34 ft. over Tioughnioga River, on Marathon-Hartford Hy. $90,000.

Oklahoma—State Hy. Dpt., Oklahoma City, preliminary plans 7 span 102 ft. rein.-con. bridge at Yale, Payne Co., $25,000—8 span 118 ft. rein.-con. trestle, at Carney, Lincoln Co., $30,000. A. R. Losh, hy. engr.

Okla., Buffalo — State Hy. Dpt., Oklahoma City, 10 span 166 ft. rein.-con. bridge, Harper Co. $35,000. A. R. Losh, hy. engr.

Texas—State Hy. Comn., W. R. Ely, chn., Austin, soon takes bids rein.-con. bridges over San Marcos River Relief, Federal Aid Project 79 Reopened. $75,000. G. G. Wickline, Austin, bridge engr.

Texas—State Hy. Comn., W. R. Ely, chn., Austin, soon takes bids 1,036 ft. rein.-con. steel bridge over Colorado River, Hy. 10, Hood Co. $100,000.

Tex., Fort Worth — City, c/o O. E. Carr, final plans widening bridge, from 36 to 60 ft. and adding 2 side walls over Sycamore Creek, at Vickery Blvd. $25,000. D. L. Lewis, Fort Worth, engr.

Texas and Oklahoma—Texas State Hy. Comn., W. R. Ely, Austin, and Oklahoma Hy. Comn., Oklahoma City, Okla., soon take bids 3,705 ft. concrete, steel I-beam bridge over Red River, between Texas and Oklahoma State Aid Project 928-E, Wilbarger Co., Tex. $150,000.

BIDS ASKED

California — Mar. 4, by State Hy. Comn., Sacramento, three 27 ft. span rein.-con. girder bridge on concrete pile bents over San Francisquito Creek, at Palo Alto, San Mateo and Santa Clara Counties—100 ft. span rein.-con. arch bridge over Gaviota Creek, Santa Barbara Co. C. H. Purcell, hy. engr.

Calif., San Francisco — Feb. 25, by S. J. Hester, secy. Bd. P. Wks., City Hall, 140 ft. span single leaf bascule bridge, 80 ft. wide, 103 ft. between fenders, 6 ft. sidewalks, 2 street railway tracks, Belt R.R. track, in addition to vehicular traffic over Islais Creek channel, at 3rd St. $400,000. M. M. O'Shaughnessy, city engr. Noted July 24.

Illinois—Mar. 4, by State Dpt. P. Wks. & Buildings, Div. Hys., Springfield, three 50 ft. span rein.-con. girder bridge, Route 62, Sect. 117-B, Cook Co.—one 55 ft., four 40 ft. span rein.-con. girder bridge, two 26 ft. span rein.-con. slab bridge, Route 72, Sect. 127-B, DeKalb Co.—rein.-con. culvert, rein.-con. substructure,

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Bridges (Continued)

Route 80, Sect. 107-B—120 ft. steel superstructure, Route 80, Sect. 107-C—one 45 ft. and two 35 ft. span rein-con. bridge, Route 80, Sect. 109-B, all Whiteside Co.—rein-con. substructure, two 80 ft. span steel superstructures, Route 95, Sect. 120-B and C, McDonough Co.—50 ft. span rein-con. girder bridge, Route 96, Sect. 125-B, Hancock Co.—rein-con. substructure, three 20 ft. span rein-con. slab bridge, Route 103, Sect. 102-B—two 100 ft. span steel superstructure, Route 103, Sect. 102-C, both Schuyler Co. F. T. Sheets, ch. hy. engr.

Md., Baltimore—Feb. 25, by Bd. Awards, structural steel beam bridge, Ponca St. N. L. Smith, Municipal Bldg., hys. engr.

Md., Baltimore — Mar. 4, at office City Register, Baltimore St. Bridge over Gwynn's Falls; adv. E. N.-R. Feb. 19. Noted Dec. 25.

Michigan—Feb. 24 (extended date), at office R. A. Beers, resident engr., Kalamazoo, MBr. 1 of 80-14-2, Contrs. 2 and 3, 2 rein.-con. abutments, steel deck girder, two 6 ft. sidewalks, Van Buren Co., for State Hy. Dpt., Lansing. Noted Feb. 12.

Michigan — Feb. 25, by H. G. Rose, div. bridge engr., Grand Rapids, MBr. 1 of 34-6-3, Contrs. 2 and 3, 2 rein.-con. abutments, steel deck girder, concrete flooring, surfacing, Ionia Co., for State Hy. Comn., Lansing.

Minnesota—Mar. 3, by State Hy. Dpt., St. Paul, Bridge 5034, 75 ft. long, concrete, S. P. 7-31-1, near Walnut Grove; Bridge 5035, 160 ft. long, near Lamberton, Redwood Co.

Mississippi—See "Streets and Roads."

Missouri—Feb. 28, by State Hy. Bd., Jefferson City, bridges in Cass, Christian, Dent, Jasper, New Madrid, Nodaway, Phelps, Ste. Genevieve, Shelby and Webster Counties.: T. H. Cutler, state hy. engr.

Nebraska—Feb. 27, by R. L. Cochran, engr. State Hy. Comn., Lincoln, 3 steel deck, rein.-con. girder bridges, on Greenwood Chalco Rd., Saunders Co. $80,000.

Nevada—Feb. 25, by State Hy. Comn., Carson City, 174 ft. concrete bridge near Woolsey (Loveloch), Pershing Co. $44,727. S. C. Durkee, state hy. engr.

New Jersey—Mar. 2, by State Hy. Comn., Trenton, constructing Hackensack River Bridge, on Route 4, Sects. 3, and 4; 4 bridges no Route 4, Sect. 4, all foregoing Bergen Co. A. L. Grover, ch. engr.; adv. E. N.-R. Feb. 19.

N. J., Salem—Mar. 6, by Bridge Com. of Bd. Freeholders Salem Co., constructing Courses Landing Bridge 4,000 over Salem Creek, on Pointers-Auburn Rd., Upper Penns Neck, Pilesgove and Mannington Twps. H. B. Keasbey, 90 Market St., co. engr.; adv. E. N.-R. Feb. 19.

N. Y., Buffalo—Feb. 24, by Erie Co., County Bldg., concrete slab bridges over Hayes Hollow Rd., Colden—on Rice Rd., Elma—concrete box culvert on Grover Rd., Aurora. G. Diehl, Ellicott Sq., co. engr.

Oklahoma—Feb. 24, by State Hy. Dpt., Oklahoma City, concrete slab surfacing 46,930 sq.yd. U. S. Hy. 66, west of Erick, $68,000—41,600 sq.yd. U. S. Hy. 66, east of Texas State Line, $60,000—29,300 sq.yd. U. S. Hy. 66, east of Elk City, $42,000, all Beckham Co.—29,000 sq.yd. U. S. Hy. 75, south of Colbert, Bryan Co., $40,000—35,200 sq.yd. West El Reno Rd., U. S. Hy. 66, $51,000—442,250 sq.yd. South El Reno Rd., U. S. Hy. 81, $85,000—44,250 sq.yd. West Ft. Reno Rd., $62,000—56,380 sq.yd. Union City Rd., U. S. Hy. 81, $81,000, all Canadian Co.—46,930 sq.yd. Washita County Line Rd., U. S. Hy. 66, $68,000—60,000 sq.yd. Clinton Rd., U. S. Hy. 66, $87,000, both Custer Co.—75,350 sq.yd. Chickasha-Tablor Rd., U. S. Hy. 277, Grady Co., $110,000—61,100 sq.yd. Horns Corners Rd., U. S. Hy. 75, Hughes Co., $85,000—46,930 sq.yd. Ryan Rd., U. S. Hy. 81, $68,000—51,200 sq.yd. Red River Rd., U. S. Hy. 81, $72,000, both Jefferson Co.— 72,700 sq.yd. Oklahoma County Line Rd., U. S. Hy. 266, Lincoln Co., $107,000 — 47,000 sq.yd. Mackintosh County Line Rd., U. S. Hy. 73, Muskogee Co., $68,000—46,930 sq.yd. Morrison Rd., U. S. Hy. 64, $68,000—51,800 sq.yd. Lela Rd., U. S. Hy. 64, $75,000, both Noble Co.—28,340 sq.yd. Harrah Rd., U. S. Hy. 266, Oklahoma Co., $41,000—82,400 sq.yd. Stillwater Rd., U. S. Hy. 40, Payne Co., $119,000—64,600 sq.yd. Chelsea Rd., U. S. Hy. 66, $96,000—46,930 sq.yd. South Chelsea Rd., U. S. Hy. 66, $68,000—46,930 sq.yd. East Bushyhead Rd., U. S. Hy. 66, $68,000—46,930 sq.yd. East Foyal Rd., U. S. Hy. 66, $68,000—46,930 sq.yd. Sequyoah Rd., U. S. Hy. 66, $68,000 —38,160 sq.yd. Clairmore Rd., U. S. Hy. 66, $58,000, all Rogers Co.—17,000 sq.yd. West Canute Rd., U. S. Hy. 66, $25,000—46,930 sq. yd. East Canute Rd., U. S. Hy. 66, $68,000—46,930 sq.yd. East Foss Rd., U. S. Hy. 66, $68,000—46,930 sq.yd. West Foss Rd., U .S. Hy. 66, $68,000, all Washita Co. A. R. Losh, hy. engr.

Rhode Island—Mar. 4, by State Roads Dpt., Providence, **(F.A.P. means Federal Aid Project)**, constructing Washington R.R. Bridge, F. A. P. 46G, in Coventry—Union Village Bridge F. A. P. 31C, North Smithfield—Usquepaug River Bridge in Richmond and South Kingstown; adv. E. N.-R. Feb. 19.

Texas—Feb. 27, by G. Gilchrist, state hy. engr., Austin **(F.A.P. means Federal Aid Project)**, 20 deck girder span, relief bridge over San Marcos River and 7 deck girder span bridge over Seals Creek, Hy. 3-A, F. A. P. 70 reopened, Caldwell Co., $56,000—28 concrete girder span bridge over Leon River, Hy. 10, F. A. P. 580-G, Comanche Co., $170,000—10 rein.-con. deck girder bridges, on Hy. 14, F. A. P. 384-B and 507-B, Ellis Co., $180,000—7 rein.-

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con. deck girder bridges on Hy. 6, F. A. P. 471-G, Brazos Co., $80,000.

Texas—Feb. 28, by G. Gilchrist, state hy. engr., Austin **(F.A.P. means Federal Aid Project)**, 3 steel, concrete, timber pile bridges on Hy. 145, State Project 931-E, Live Oak Co., $56,000—3 steel truss span, 2 I-beam spans and 16 concrete deck-girder spans, on Hy. 10 over Brazos River, F. A. P. 92-B, Hood Co., $120,000—one 130 ft. steel truss span on concrete piers, two 40 ft. and one hundred and twenty 20 ft. steel I-beams over Neches River, on Hy. 40, Jasper and Tyler Counties, $140,000—ten 20 span relief bridge, eighteen 20 ft. span, three 40 ft. spans and sixty-six 20 ft. span steel I-beam stringers, treated timber bridges on Hy. 43, Leon and Robertson Counties.

Tex., Houston—Feb. 28, by Harris Co., 10 span, 325 ft. concrete bridge, Poast Oak Rd. $30,000. C. Haile, Houston, co. engr.

Vermont—Feb. 27, by Hy. Dpt., Montpelier, two 45 ft. concrete T-beam and concrete slab bridges, concrete approaches over Furnice Brook, Pittsford; concrete, steel bridges, gravel approaches, Springfield.

Virginia—See "Streets and Roads."

Virginia—Feb. 24, by State Hy. Comn., Richmond, 279 ft. bridge over Nansemond River, Route 10, Project F-333-B, at Reids Ferry, near Suffolk, Nansemond Co.—127 ft. bridge over Po River, Route 51, Project S-695-B, near Fredericksburg, Spotsylvania Co.—gravel surfacing 7.4 mi. Balcony Falls-Buena Vista Rd., Route 14, Project F-597-A1, Rockbridge Co. H. G. Shirley, ch. hy. engr.

CONTRACTS AWARDED

California — State Hy. Comn., Sacramento, widening bridges over Topanga and Las Flores Creeks, grading, asphaltic concrete surfacing approaches, Los Angeles Co., to Owl Trucking Co., Inc., Compton, $27,370. Noted Jan. 8.

Georgia—J. W. Barnett, engr. State Hy. Dpt., East Point, 3 bridges on Gainesville-Cleveland Rd., Federal Aid Project 220-D, Hall Co., Kershaw Constr. Co., Woodward Bldg., Birmingham, Ala., $72,028; 8 bridges on Quitman-Moultrie Rd., Federal Aid Project 38 and 88 B, Brooks Co., to E. Pettus, Montgomery, Ala., $72,028.

Indiana—State Hy. Comn., Indianapolis, three 20 ft. span rein.-con. slab bridge, 24 ft. roadway, two 20 ft. span rein.-con. slab bridge, 24 ft. roadway and one 50 ft. rein.-con. arch bridge, 24 ft. roadway, Clay Co., to R. P. Olinger, Huntingburg, $22,766 est. $20,987; 2 rein.-concrete slab bridges, 1 rein.-con. girder bridge, Lawrence Co., to A. G. Ryan Contg. Co., Chrisney, $17,345 est. $23,155. Noted Jan. 15.

Massachusetts—Dept. P. Wks., Boston, repairs to superstructure, draw span and machinery of bridge over Acushnet River between New Bedford and Fairhaven, to Coleman Bros., Inc., 245 State St., Boston, $95,800. Noted Jan. 22.

Mississippi—State Hy. Comn., Jackson, 4 concrete bridges, on Hickory-Chunky Rd., Federal Aid Project 6, Newton Co., to J. P. Rowan, Holly Springs, $32,283. Noted Feb. 5.

Missouri—State Hy. Dpt., Jefferson City, to Samples & Elsea, Kirksville, bridges over Kings Lake Drainage Ditch, Lincoln Co., $2,475—to Knutson Bros., 3520 Main St., Kansas City, over Davis Creek, $12,716; over Spring Creek, $16,262, both Adair Co.—to Richmond Constr. Co., Advance, over St. Francis River East, Dunklin Co., $2,682; over Drainage Ditch, Scott Co., $2,698—to Lahar Constr. Co., Boonville, over Drainage Ditch 106, Stoddard Co., $3,314; over Branch, $1,487, over Drainage Ditch 111, $3,490, over Drainage Ditch 104, $4,020, all foregoing Bollinger Co.—to M. E. Gilliox, Monett, over Creek, Carter Co. $2,893; over Middle Fork, Crooked River, $18,284, over Branch, $2,300; over West Branch Crooked River, $14,299, all foregoing in Ray Co.; over Branch, $970; over Hunter Creek, $3,803, over branch Cedar Creek, $415, over Bennett Creek, $6,148; constructing retaining wall $745, all foregoing Wayne Co.—to O. O. Fuller, Nevada, bridges over Hovey Cypress Drainage Ditch, $5,761, over Kinna More Drainage Ditch $3,614; over Seneca Slough, $1,560, over drainage ditch $1,534; over drainage ditch, $1,459, over Drainage Ditch 24, $3,642; over Drainage Ditch 5, $3,372; over Buffalo Ditch 5, $3,416; over Pole Cat Drainage Ditch $6,093, all foregoing Dunklin Co.—to M. Wunderlich, 734 Snell Ave., St. Paul, Minn., over Brewery Branch, $1,971; over Willow Fork Creek, $5,075; over Schmidt Branch, $3,129, all foregoing in Moniteau Co.; over Fox Creek, $1,534; over Brush Creek, $10,600, both Douglas Co. Grand total $151,761. Noted Jan. 15.

New York—W. G. Hickman, comr. Erie Co., 29 County Hall, bridges on Spaulding Rd., in Concord, to North Fillmore Concrete Co., 119 Harriet St., Buffalo, $4,400—on Three Rod Rd., Marilla, to A. Stutzman, 27 Lavarack Ave., Lancaster $2,716—on Hayes Hollow Rd., Colden, to Hessel & Son, East Aurora, $4,560—on Buffalo Creek Rd., Wales, to B. Behringer, Genesee Rd., Forks, $6,350— on Swift Mills Rd., Newstead, to Queen Constr. Co., Harlem Rd. and Clinton Forks, Buffalo, $13,743. Grand total $31,769. Noted Jan. 29.

N. Y., Buffalo—W. G. Hickman, comr. Erie Co., 29 County Hall, concrete slab bridges on Duerr Rd., East Hamburg, to Holmes & Murphy, Orchard Park, $3,174—on Delameter Rd., Evans, to Town of Evans, $3,881—on Whitehaben Rd., Grand Island, to Hessel & Sons, East Aurora, $7,990—William Street Rd., Lancaster, to L. Gambin, 31 Harriett St., Buffalo, $8,235—over Eighteen Mile Creek, on Clarksburg-New Oregon Rd., Hamburg, to Stapell, Munn & Beals, Camp Rd. and Erie R.R., Hamburg, $10,684. Grand total $33,964. Noted Jan. 22.

Oklahoma — State Hy. Dpt., Oklahoma City, 80 ft. bridge near Nash and 80 ft. bridge at Pond Creek, both Grant Co., to R. R. Tway, 237 East 15th St., Oklahoma City, $27,215 and $25,230 respectively est. $30,000 each—140 ft. bridge near Lawton, Comanche Co., to Southwest Bridge & Culvert Co., Majestic Bldg., Oklahoma City, $32,764 est. $35,000—bridge near Welch, Craig Co., to H. L. Cannady & Co., 1122 South Lewis St., Tulsa, $28,796 est. $35,000—65 ft. bridge near Kingfisher, Kingfisher Co., to Ashplund Constr. Co., Enid, $18,905 est. $25,000 — bridge near Cheyenne, Roger Mills Co., to Richard & Moorman, Majestic Bldg., Oklahoma City, $24,325 est. $27,000—90 ft. bridge near Maniteau, Tillman Co., to Portwood & Dennison, Hobart, $21,509 est. $25,000—bridge at Bessie, Washita Co., to Nina & Frost, Hydro, $18,383 est. $25,000. Grand total $197,127. Noted Jan. 29.

Wisconsin — State and Ashland, Burnett, Douglas, Rusk and Sawyer Counties, Superior, to Peppard & Fulton, Superior, constructing Desmond Bridge, Douglas Co. $5,141—to J. E. Hinman & Son, Glenwood City, North Brule Bridge, Douglas Co., $16,976—to A. Brown & Co., Chippewa Falls, Teal Creek Bridge, Sawyer Co., $4,425—to V. Nelson, Superior, channel change Project 8385, Burnett Co., $6,198—to R. H. Ohlfs, Ladysmith, South Bridge $128; West Bridge $3,632; Central Bridge $4,703, all Rusk Co.—to L. G. Arnold, Inc., Eau Claire, Dryden Bridge, Ashland Co., $4,005; Leo Creek Bridge, $2,069; Anderson Bridge, $3,179; Barden Bridge, $8,648, all foregoing in Douglas Co. Grand total $59,104.

Wisconsin—State and Rock Co. Hy. Comns., State Capitol Annex, Madison, Turtle Creek Bridge, Overhead, approaches, to Hansen-Beckman & Co., Beloit, $107,902. Noted Feb. 5.

Vermont—State Hy. Dpt., Montpelier, 28 ft. T-beam bridge, gravel approaches over Stevens River, Williamstown, to C. D. Marsh Constr. Co., Woodsville, N. H., $12,234; 3 span concrete bridge, gravel approaches, over East Creek Lester, to Earl & Merry, Rutland $19,630. Noted Feb. 12.

STREETS AND ROADS

BIDS ASKED

Ark., Ft. Smith—Bids about Mar. 6, grading, curbing, concrete paving 6th and North 2nd Sts., from Garrison Ave. to B St., North B St. from 2nd to 13th Sts. $70,000. W. L. Winters, 311 Merchants Natl. Bldg., engr.

California — Mar. 4, by State Hy. Comn., Sacramento, grading, asphaltic concrete surfacing 9.8 mi. road point 1.5 mi. south Santa Margarita and Atascadero, San Luis Obispo Co.; grading, oil treated crushed gravel or stone surfacing 13.6 mi. road between Cronise Valley and point 6 mi. west of Baker, San Bernardino Co. C. H. Purcell, P. Wks. Bldg., hy. engr.

Calif., Fresno—Feb. 27, by D. M. Barnwell, clk. Fresno Co., Jensenite or Permanite asphaltic concrete paving 0.75 mi. Mt. Whitney Ave. near Riverdale.

Calif., Oakland — City Council taking new bids curbing, guttering, sidewalks, hot oil penetration macadam on 5 in. macadam paving 8th, 10th and Fallon Sts. Former contract rescinded. Noted Feb. 5, under "Contracts Awarded."

Calif., Santa Ana—Mar. 3, by Bd. Supervs. Orange Co., improving Santiago Blvd., incl. 15,330 lin.ft. grading, 2,000 cu.yd. gravel base and shoulders, 8,000 tons asphaltic concrete pavement. $40,000 or more.

Delaware—Mar. 3, by State Hy. Dpt., Dover, clearing, grubbing, grading, concrete paving 16.34 mi. Georgetown-Milford, Du Pont Rd. widening, Contr. 173—clearing, grubbing, grading, concrete paving 5 mi. Millsboro-Bryans Store, Contr. 174—clearing, grubbing, 4.6 mi. Bryans Store-Hardscrabble, Contr. 174-A — clearing, grubbing, grading, concrete sidewalks, concrete paving 0.874 mi. 43rd St. cutoff, Wilmington, Contr. 183—1,300 rods woven wire fence, 36 intermediate and end posts, 12 entrance gates, 13 corner posts, fencing 4.31 mi. Fieldsboro-Drawyers, Contr. 182F—steel superstructure Marshallton Bridge, Contr. 144 — fencing 4.91 mi. St. Georges-Drawyers, Contr. 169F; adv. E. N.-R. Feb. 19.

Florida—Feb. 27, by State Road Dpt., Tallahassee, clearing, grubbing, grading, drainage structures, concrete paving 10.31 mi. Road 5, Federal Aid Project 76-A, Hillsborough Co. B. M. Duncan, state hy. engr.

Georgia — Feb. 24, by J. W. Barnett, state hy. engr., East Point **(F.A.P. means Federal Aid Project)**, paving 11 mi. Bainbridge-Cario Hy., F.A.P. 325-D, Decatur Co.—8.352 mi. Bainbridge-Donaldsonville Rd., F.A.P. 442, Seminole Co.—grading, 1 bridge on 1.6 mi. Sparta-Warrenton Rd., F.A.P. 138-A, Hancock and Warren Counties—grading, 1 bridge culvert on 9.5 mi. Athens-Danielsville Rd., F.A.P. 126-A and B, Madison Co.—paving, 3 bridges on 5.085 mi. Royston-Hartwell Rd., F.A.P. 231-B and 36-A, Hart Co.—grading, 2 bridges, 6.563 mi. Thomasville-Cario, F.A.P. 74-B and 122, Grady Co.

Illinois—Mar. 4, by State Dpt. P. Wks. & Buildings, Div. Hys., Springfield, concrete, bituminous filled brick on concrete, bituminous concrete (fine or coarse graded aggregate type) on concrete surfacing 0.39 mi. Route 1, Sect. 161-Y-1—2.3 mi. Route 46, Sect. 464-Y-1—6.13 mi. Route 46, Sect. 465-Y—2.29 mi. Route 62, Sect. 117, all Cook Co.—7.67 mi. Route 47,

Streets and Roads (Continued)

Sect. 108, Kane and Kendall Counties—8.41 mi. Route 59, Sect. 112, DuPage Co.—7.47 mi. Route 72, Sect. 127, DeKalb Co. — 5.94 mi. Route 83, Sect. 129-K, Mercer Co.—0.51 mi. Route 91, Sect. 105—0.25 mi. Route 91, Sect. 107, both Knox Co.—6.46 mi. Route 94, Sect. 112, Henderson and Hancock Counties—9.12 mi. Route 95, Sect. 120, McDonough Co.—5.5 mi. Route 96, Sect. 124—5.6 mi. Route 96, Sect. 125, both Hancock Co.—5.3 mi. Route 103, Sect. 101—6.59 mi. Route 103, Sect. 102, both Schuyler Co.—6.9 mi. Route 104, Sect. 124, Morgan Co.—grading, drainage structures 4.6 mi. Route 80, Sect. 107-A, Carroll and Whiteside Counties—6.3 mi. Route 80, Sect. 109-A, Whiteside Co.—1.9 mi. Route 80, Sect. 110-A, Rock Island Co. F. T. Sheets, ch. hy. engr.

Ind., Princeton — Mar. 3, by Bd. Comrs. Gibson Co., concrete surfacing E. H. Baker Rd., $26,000; Joseph Wolfe Rd., $11,889. S. G. Marshall, Princeton, aud.

Ind., Shelbyville—Bd. Comrs. Shelby Co. bids about Mar. 1, concrete surfacing 9,600 ft. Talbert Rd. $39,562. R. Cochran, Shelbyville, engr.

Ind., Warsaw — Mar. 1, by Bd. Comrs. Kosciusko Co., concrete surfacing 2 mi. Herbert Robinson Rd., 20 ft. $50,000. W. Taylor, Warsaw, engr.

Ia., Mason City—Feb. 24, at office Auditor Cerro Gordo Co., grading 10 mi. secondary roads.

Kansas—Feb. 23, by State Hy. Comn., Court House, Iola, concrete surfacing 2.676 mi. U. S. Hy. 73-W, Federal Aid Project 283-A, Allen Co.—grading, culverts 4.172 mi. K. 6, Federal Aid Project 339-C—4.994 mi. K. 38, Federal Aid Project 339-D, both Anderson Co. W. V. Buck, hy. engr.

Kansas—Feb. 27, by State Hy. Comn., Court House, Winfield (**P. means Project, F.A.P. means Federal Aid Project**) concrete surfacing 3.486 mi. P. 77-A, F. A. P. 230-B—3.647 mi. P. 77-3 and 4, F. A. P. 230-A—3.879 mi. P. 77-3, F. A. P. 230-F—0.138 mi. P. 77-3 and 4, F. A. P. 230-D, all Cowley Co. W. V. Buck, Topeka, hy. engr.

Kentucky — Mar. 11, by State Hy. Dpt., Frankfort, grading, drainage structures 8.2 mi. Burkesville-Albany Rd., Cumberland Co. B. Johnson, chn.

Ky., Louisville—Feb. 24, by Dpt. P. Wks., various types paving streets mostly in southern section. A. A. Krieger, City Hall, engr.

Louisiana — Mar. 17, by State Hy. Comn., Baton Rouge, grading, gravel and shell surfacing 7.611 mi. New Basin Canal-Kenner Rd., Orleans and Jefferson Parishes—amiesite surfacing 18.1 mi. Bunkie-Marksville Hy., Avoyelles Parish—asphaltic surfacing 10 mi. Belair-Braithwaite Hy., Plaquemine Parish—26 mi. Lucky-Ringgold-Loggy Bayou Hy., Bienville and Bossier Parishes—2.95 mi. Toomen-Texas Hy., Calasieu Parish—5.8 mi. Patterson-Calumet Hy.—concrete surfacing 18.58 mi. Centerville-Berwick Hy., both St. Mary Parish—4.7 mi. Grand Encore-Winnfield Hy., Natchitoches Parish—15.52 mi. Napoleonville-Thibodaux Hy., Assumption and Lafourche Parishes—5.43 mi. Clinton-Baton Rouge Hy., East Feliciana Parish. H. B. Henderlite, hy. engr.

La., Tallulah—Mar. 4, by Police Jury Madison Parish, gravel surfacing 7 mi. Lund-Fortune-Fork-Algadon Rd. P. O. Benjamin, Tallulah, engr.

Maine — Feb. 25, by Hy. Dpt., Augusta, graveling 5.88 mi. hy. Orland—3.26 mi. hy. Stockton Springs and Orland—1.18 mi. hy. Avon—concrete paving 9.03 mi. hy. Carmel—2.84 mi. hy. Warren—bituminous macadam and gravel surfacing 2 mi. Bingham and Moscow.

Maryland—Feb. 24, by State Roads Comn., G. C. Uhl, chn., Baltimore, concrete paving 1 mi. F.A.P. 230-A, Contr. Ho-91-54, Howard Co.—1.1 mi. Contr. B-181-711, and concrete shoulders on 2.99 mi. hy. F.A.P. 223, Contr. B-180-411, both Baltimore Co. — concrete paving 2 mi. F.A.P. 224-A, Contr. Wi-63-12, Wicomico Co.; adv. E. N.-R. Feb. 19.

Md., Baltimore — Feb. 25, by Bd. Awards, curbing, 25,000 lin.ft. streets listed in Contr. 582; sheet asphalt paving 8,200 sq.yd. streets listed in Contr. 581. N. L. Smith, Municipal Bldg., hys. engr.

Mass., Needham—See "Contracts Awarded."

Michigan—Feb. 24 (extended date), by R. A. Beers, resident engr., Kalamazoo, grading, shaping, drainage structures, concrete paving 4.942 mi. FO78-11C-3 and F.A. Br. 1 of 78-8-4C, 1 and 2, 2 rein.-con. abutments, steel deck girder, concrete flooring, St. Joseph Co., for State Hy. Comn., Lansing. Noted Feb. 12.

Michigan—Feb. 24, by A. L. Burridge, div. engr., Cadillac, grading, shaping, drainage structures 10.786 mi. FO6-12, Contr. 2, Arenac Co., for State Hy. Comn., Lansing.

Michigan—Feb. 24 (extended date), by A. L. Burridge, div. engr., Cadillac, grading, drainage structures 6.581 mi. FO10-6, Contr. 2, Benzie Co., for State Hy. Comn., Lansing. Noted Feb. 12.

Minnesota—Mar. 3, by State Hy. Dpt., 1246 University Ave., St. Paul, concrete paving 121,894 sq.yd. S. P. 7-45, Sect. 2, F. A. P. 62 and S. P. 7-43, Sect. 3, F. A. P. 290-B —152,771 sq.yd. S. P. 9-40, Sect. 1, F. A. P. 398—311,125 sq.yd. S. P. 9-48, S. P. 9-41, Sect. 2, S. P. 9-38 and S. P. 9-33, F. A. P. 311-A—9.7 mi. S. P. 18-21, F. A. P. 217—122,609 sq.yd. S. P. 18-21, F. A. P. 217, and S. P. 18-23, Sect. 1—57,852 sq.yd. S. P. 20-24—132,339 sq.yd. S. P. 20-35, Sect. 2, S. P. 20-35, Sect. 1, and S. P. 20-32—grading 16.3 mi. S. P. 7-31, Sect. 2, and S. P. 7-39, Sect. 3—14.9 mi. S. P. 9-30, Sect. 1—5.4 mi. S. P. 17-26—11.9 mi. S. P. 32-28 and S. P. 32-25, Sect. 1—15.8 mi. S. P. 53-21. State furnishes cement.

Minn., Duluth—Feb. 24, by St. Louis Co., clearing County Roads 33, 43, 303, 625, 251, 254—cleaning creek on latter road—graveling State Aid Rds. 37 and 4, Town Rd. 912, County Roads 92, 285, 540, 15, 58, 141, 151, 152, 160, 162, 172, 192, 229, 254, 675, 52, 61, 316—patch graveling County Road 6—resurfacing Co. Rd. 29—clay surfacing Co. Rd. 202—fill and gravel Co. Rd. 301—side ditching on Co. Rd. 392 Projects 1 and 2—widening Embarras River—improving bridges on Rd. 21, Projects 1 and 4; on Rd. 88, Project 2; on Rd. 403, Project 1. $56,114. S. Shepard, Court House, co. engr.

Missouri—Feb. 28, by State Hy. Bd., Jefferson City, concrete surfacing roads in Andrew, Buchanan, Cape Girardeau, Clinton, Jasper and Ray Counties—10 in. concrete paving, graveling roads in Cape Girardeau and New Madrid Counties—graveling roads in Christian, Dent, Phelps, Ste. Genevieve and Shelby Counties—grading Andrew, Buchanan, Cape Girardeau, Cass, Clay, Clinton, Jasper, New Madrid, Nodaway, Ray and Webster Counties. T. H. Cutler, state hy. engr.

Mo., St. Louis — Mar. 17, by Bd. P. Serv., City Hall, concrete paving, sidewalks, Grand Dr., Lindell and Union Blvds. in conjunction with viaducts over Wabash and Rock Island Railroads, Forest Park $105,000 — grading, curbing, rein.-con. paving 1,800 sq.yd. Leona St., $9,920, grading, curbing vibrolithic concrete paving 2,300 sq.yd. Connecticut St., $12,840—3,380 sq.yd. Oriole Ave., $19,200—3,695 sq.yd. Rosalie St., $21,160 — grading, curbing, asphaltic concrete paving 1,790 sq.yd. Graham St., $15,360, 1,750 sq.yd. Park Lane, $15,160—grading, curbing, warrenite bitulithic paving 2,200 sq.yd. Wyoming St., $19,920 — 1,300 sq.yd. Winnebago and Jefferson Sts., $11,960. W. W. Horner, city engr.

Nebraska—Feb. 27, by R. L. Cochran, engr. State Hy. Comn., Lincoln, grading, concrete paving 4.3 mi. F. A. P. 312, Lancaster Co. $90,000—4.2 mi. F. A. P. B and D, Saunders Co., $200,000—2 mi. F. A. P. 177, Buffalo Co., all 20 ft. wide.

Nevada — Feb. 25, by State Hy. Comn., Carson City, grading, graveling, and mixed in place or premixed oil surfacing 28.46 mi. Battle Mountain East Rd., Lander and Eureka Counties, S. C. Durkee, state hy. engr.

New Jersey — Mar. 2, by State Hy. Comn., Trenton, grading, 9 in. single line rein.-con. paving 0.21 mi. Route 3, Sect. 3A, Paterson, Passaic Co.—grading, bridging, 10 in. double line rein.-con. paving 0.678 mi. Route 1, Sect. 6, Fort Lee, Bergen Co.—8 in. single line rein.-con. paving 4.79 mi. Route 47, Sects. 1A and 2A, Cumberland Co.—3.57 mi. Route 47, Sect. 3A, Atlantic, Cumberland and Cape May Counties. A. L. Grover, ch. engr.; adv. E. N.-R. Feb. 19.

New Mexico — Feb. 25, at office W. C. Davison, state hy. engr., Santa Fe, crushing, mixing, hauling and spreading oil surfacing 13.5 mi. F.A.P. 1-B reopened between Raton and Maxwell Junction—21.9 mi. F.A.P. 27 reopened from Gallup to Guam, McKinley Co.—19.5 mi. F.A.P. 137 and 138 reopened from Portales to Roswell—18.7 mi. F.A.P. 142-C and D reopened, between Clovis and Melrose, Curry Co.—18.4 mi. F.A.P. 155-A and B reopened between Las Vegas and Wagon Mound—constructing 10.8 mi. F.A.P. 24 reopened from Clovis to Portelas, Roosevelt Co.—8 mi. F.A.P. 88-G between Algodones and Santa Fe, Santa Fe Co.—3.3 mi. F.A.P. 121-B between Mountainair and Socorro, Socorro Co.—3 mi. F.A.P. 127-C between Tucumcari and San Jon, Quay Co.—top course surfacing 12.9 mi. F.A.P. 127-B from Tucumcari to San Jon, Quay Co. — 14.5 mi. F.A.P. 162-A reopened, from Portales to Elkins, Chaves Co.—base course surfacing 6.7 mi. F.A.P. 16-A reopened from Gallup to Shiprock, McKinley Co.—8.3 mi. F.A.P. 166-A from Deming to Silver City, Luna Co.

N. Y., Amenia — Feb. 25, by Dpt. Mental Hygiene, State Office Bldg., Albany, concrete roads at Wassaic State School, Dutchess Co. F. W. Parsons, comr.; adv. E. N.-R. Feb. 19.

N. Y., Brooklyn—Feb. 25, by H. Hesterberg, pres. Brooklyn Boro. Boro Hall, grading, sidewalk space, flagging west side Gerritsen Ave.; grading asphalt on concrete paving Avenue H, Beverly Rd., Flatlands Ave., East 57th, East 95th, Elton, West 4th, 53rd and 58th Sts.

N. Y., Buffalo—Feb. 27, by G. Fisk, comr., paving Cornell St. and Harbor Turnpike—repaving Kent St.—filling Erie canal lands between Crowely Ave. and Vulcan St. W. Rathman, city engr.

N. Y., Long Island City—Feb. 24, by G. U. Harvey, pres. Queens Boro., Queens Subway Bldg., grading, curbing, sidewalks, sheet asphalt on concrete paving Newtown Bd. and 127th St.—strengthening water conduits in connection with regulating, grading Lefferts and North and South Conduit Blvds.—constructing ramps and approaches to boardwalk at foot Beach 24th, 26th, 28th and 37th Sts.—grading, laying stone block gutters, preliminary paving 82nd Ave.—widening Long Island R.R. Bridge roadway, at intersection with Bell Blvd., in connection with grading, curbing, sidewalks on Bell Blvd.—restoring surface improvements removed for constructing subway on Northern Blvd.

S. D., Huron—Mar. 3, by City, paving 3,070 ft. streets, 40 ft. $25,000. O. A. Ricker, city engr.

Texas—Feb. 27, by G. Gilchrist, state hy. engr., Austin (**F.A.P. means Federal Aid Project**), double bit. surface treating 17.13 mi. Hy. 41, Job M-15-K-8, Edwards Co., $35,000—triple bit. on caliche base surface treating 10.957 mi. Hy. 4, F. A. P. 590-A, Runnells Co., $100,000 — concrete paving 17.325 Hy. 32, F. A. P. 559 B and C and 483-A, Leon Co., $400,000, all foregoing 18 ft. wide—grading, small drainage structures 2.727 mi. Hy. 3-A, F. A. P. 79 reopened, Caldwell Co., $30,000—11.405 mi. Hy. 71, F. A. P. 417-C, Colorado Co., $66,000—12.344 mi. Hy. 7, F. A. P. 583-C, Brown Co., all foregoing 26 ft. wide.

Tex., Brownsville — Feb. 27, by City, c/o R. B. Renfro, mayor, 6 in. rein.-con.; 5 in. rein.-con. base with 1½ in. rock asphalt (hot mix), wearing surface; 5 in. rein.-con. base with 1½ in. rock asphalt (cold mix) wearing surface; 5 in. rein.-con. base with 1½ in. bitulithic wearing surface; or 2½ in. bitulithic concrete base on 3 in. compressed gravel base with 1½ in. bitulithic wearing surface on 9,000 sq.yd. Ebony Ave. from Paredes to Los Ebanos Sts., and Lincoln Blvd., from 13th to McDavitt Sts.

Tex., Brownsville—Cameron Co., taking bids hardsurfacing 18 mi. hy. and constructing 20 mi. new roads, in Precinct 4. $660,000. W. O. Washington, Brownsville, co. engr.

Tex., Claude—Taking bids alternate types paving, incl. rock base with alternate type topping, concrete curbing, 25 blocks streets in business sect. $60,000. Address Mayor.

Utah—Feb. 24, by State Hy. Comn., Salt Lake City, graveling 17.15 mi. Dixie Hy. between Shivwits and Utah-Arizona state line; grading 1.472 mi. Dixie Hy., at Santa Clara River Bridge, both Washington Co. H. S. Kerr, state hy. engr.

Vermont—Feb. 27, by State Hy. Dpt., Montpelier, rein.-con. paving 5.2 mi. hy. in Barre and Williamstown.

Virginia — Mar. 3, by State Hy. Comn., Richmond, macadam surfacing 2.5 mi. road beginning at Winchester, Frederick Co.—0.3 mi. road, also bridge over Red Creek, Wythe Co.—1.4 mi. road beginning at point 2 mi. west of Waynesboro, Augusta Co.—8 mi. Tazewell City Rd. Buchanan Co.—gravel surfacing 2.8 mi. road beginning at point 2 mi. east of Midlothian, Chesterfield Co. — concrete surfacing 5.8 mi. road beginning at point 2.7 mi. south of Suffolk—1.5 mi. Magnolia Rd., both Nansemond Co.—top-soiling 6.7 mi. road beginning at point near West Emporia, Greensville Co.—7 mi. Brunswick County Line Rd., Brunswick Co.—grading, drainage structures 7.4 mi. beginning at Madison Courthouse, Madison Co.—bridge over Swift Creek and bridge over Proctors Creek, Chesterfield Co. H. G. Shirley, hy. comr.; adv. E. N.-R. Feb. 19.

Wash., Issaquah — City Council, bids about Mar. 11, 4 mi. concrete sidewalks. $25,000. Gardner & Fischer, Arctic Bldg., Seattle, engrs. Noted Nov. 13.

Wyoming — Feb. 28, by State Hy. Comn., Cheyenne, grading, bridges, 4.592 mi. Lingle-Lusk Hy., F. A. P. 150-E, Goshen Co.—4.131 mi. Sherman-Arrada Rd., F. A. P. 206A, Sheridan Co.—9.859 mi. Worland-Tensleep Rd., Pub. Land Hy. 108C, Washakie Co.—10.167 mi. Kemmerer-Fossil Rd., F. A. P. 193C, Lincoln Co.—surfacing 22.1 mi. Dubois-Moran Rd., S. P. 891, Fremont Co.—2.826 mi. Cheyenne-Laramie Rd., F. A. P. 153-B, S. A. P. 887, Albany Co.—6.794 mi. Rock Springs-Eden Rd., S. A. P. 888,889, and 890, Sweetwater Co.—15.249 mi. Riverton-Hudson Rd., F. A. P. 202, S. A. P., 886, Fremont Co.

CONTRACTS AWARDED

Arizona—State Hy. Comn., Phoenix, grading, draining, placing subgrade stabilizer, constructing concrete bridge on F.A.P. 25-A, 25-B, 75, 86-B, and 86-G, to W. Peper, 617 Heard Bldg., Phoenix, $122,432. Noted Jan. 22.

Calif., Los Angeles—Bd. Supervs. Los Angeles Co., grading, curbing, guttering, 8-6-8 in. concrete paving 290,000 sq.ft. Sunset Blvd., to J. E. Haddock, 357 North Chester St., Pasadena, $162,295.

Calif., Oakland—F. C. Merritt, city clk., grading, curbing, sidewalks, concrete paving 295,000 sq.ft. East 8th and East 10th Sts., et al, to Central-California Road Co., 28th and Poplar Sts., $74,591.

Calif., San Francisco—Bd. P. Wks., City Hall, grading, curbing, sidewalks, concrete and waterbound macadam surfacing Montgomery St., to C. L. Harney, Call Bldg., $54,065. Noted Jan. 15.

Calif., Santa Ana—Orange Co., grading, concrete surfacing 4.666 cu.yd. Westminister Ave., to Kovacevich & Price, 4379 Tweedy Blvd., Southgate, $27,165. Noted Jan. 27.

Georgia — J. W. Barnett, engr. State Hy. Dpt., East Point (**F. A. P. means Federal Aid Project**), to Davis Constr. Co., Rhodes Harverty Bldg., Atlanta, grading 11.55 mi. Douglasville-Villa Rica Rd., F. A. P. 36, Douglas Co., $67,994, paving 6 mi. Thompson-Augusta Rd., F. A. P. 32 A and B and 141-C, Columbia and Richmond Counties, $133,662; concrete paving 7.139 mi. Austell-Douglasville Rd., F. A. P. 41 and 41-B, Cobb and Douglas Counties, $162,724; concrete paving, constructing 2 bridges on 12.5 mi. Thompson-Augusta Rd., F. A. P. 170-A and B and C, and 66, McDuffie and Columbia Counties, $292,437 — to Espy Paving & Constr. Co., 2809 Bull St., Savannah, concrete paving 8.5 mi. Swainsboro-Statesboro Rd., F. A. P. 29-C, Emanuel Co., $175,547—to H. E. Wolfe Constr. Co., St. Augustine, Fla., 7.647 mi. Thomasville-Tallahassee Rd., F. A. P. 405-B, Grady Co., $166,634—to Campbell Constr. Co., Columbus, paving, constructing bridge on 10 mi. Hawkinsville-Eastman Rd., F. A. P. 45-A and 113, Pulaski Co., $190,485; limerock base surface treating, and 2 bridges on 7.82 mi. same road, F. A. P. 475-B, Dodge Co., $140,116—to J. B. Cochran, 878 Fair St. S. E., Atlanta, asphalt

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Streets and Roads (Continued)

on limerock surface treating 11 mi. Dawson-Richland Rd., F. A. P. 347, Terrell Co., $183,747—to S. E. Finley, 292 North Ave. N. E., Atlanta, 14.7 mi. Baxley-Lumber City Rd., F. A. P. 476-B and 210 A-C, Jeff Davis and Appling Counties, $214,535—to Coffee Constr. Co., Eastman, grading 5 mi. Hazelhurst-Baxley Rd., F. A. P. 476-A, Jeff Davis Co., $38,881—to Nichols Constr. Co., 1281 La France St. N. E., Atlanta, 8.7 mi. Zebulon-Thomaston Rd., F. A. P. 259-B, Pike Co., $45,870—to Langston Constr. Co., Orlando, Fla., 12.8 mi. Quitman-Moultrie Rd., F. A. P. 38 and 88-B, Brooks Co., $63,111. Grand total $1,875,743.

Indiana—State Hy. Comn., Indianapolis, concrete surfacing 11.102 mi. roads in Blackford and Jay Counties, to P. B. Putman, 2222 Kennington St., Ft. Wayne, $189,512 est. $250,736—0.199 mi. Jefferson Co., to Indiana Road Paving Co., Rochester, $11,290 est. $11,786—4.851 mi. Elkhart Co., to Rieth-Riley Constr. Co., Goshen, $73,286 est. $101,618—7.878 mi. Franklin Co., to Globe Constr. Co., 2307 West Franklin St., Evansville, $177,324 est. $199,270—6.529 mi. Greene Co., to J. J. Quinn Co., Bedford, $152,579 est. $172,200—grading 12.92 mi. Dubois and Martin Counties, to Foulkes Contg. Co., 705½ Ohio St., Terre Haute, $146,435 est. $212,645. Grand total $750,426. Noted Jan. 8.

Ia., Monticello—Curbing, guttering, 7 in. rein.-con. paving 16,000 sq.yd., to Haegg Constr. Co., Cedar Rapids, at $1.74 per sq.yd. Noted Jan. 22.

La., Monroe—City Council, curbing, guttering, sidewalks, sheet asphalt surfacing 3,375 sq.yd. M St., to Monroe Constr. Co., Monroe, $12,686. Noted Jan. 22.

Maryland—State Roads Comn., Baltimore, concrete paving 1.55 mi. Contr. Wi-55-12, Wicomico Co., to George & Lynch, Dover, Del., $23,969. Noted Jan. 15.

Md., Baltimore—Bd. Awards, N. L. Smith, rys. engr., Municipal Bldg., grading 60,000 cu.yd., to P. Reddington & Son, 2 East Lexington St., $37,475—sheet asphalt paving 8,300 sq.yd. streets listed in Contr. 575, to American Paving Co., Montebello Ave., $36,271—concrete paving 10,450 sq.yd. streets listed in Contr. 576, to Arundel Contg. Co., 910 Trinity St., $20,498. Grand total $84,244.

Massachusetts—District Comn., 20 Somerset St., grading, sewers, curbing, walks, bituminous macadam penetration surfacing Felsway East extension in Malden, Stoneham, Melrose and Lynn, to C. M. Callahan, Inc., 23 South Fairview St., Roslindale, $152,344.

Mass., Needham — Reconstructing Coulton Park and Hillcrest Rd., day labor, $25,000.

Michigan — At office R. A. Beers, resident engr., Kalamazoo, grading, shaping, drainage structures, widening, concrete paving 3.778 mi. FO11-29C-1, Berrien Co., 40 ft., to Grace Constr. Co., Marshall, for State Hy. Comn., Lansing, $195,157, incl. cement. Noted Jan. 8.

Missouri—State Hy. Dpt., Jefferson City, to O. O. Fuller, Nevada, grading, graveling 0.224 mi. Dunklin Co. $4,282—to M. Wunderlich, 734 Snell Ave., St. Paul, Minn., graveling 3.462 mi. Tipton-Fortuna Rd., Route 5, Sect. 51, $26,969; 2.928 mi. Sect. 52 same road $18,989, both Moniteau Co.; 4.18 mi. Ava-Howell Rd., Route 14, Sect. 27, $33,934; 3.806 mi. Sect. 28 same road $31,006, both Dougles Co. — to Lahar Constr. Co., Boonville, 3.581 mi. Zalma-Stoddard County Rd., Sect. 27, $32,567; 3.82 mi. Sect. 28 same road $25,195, both Bollinger Co.; 1.67 mi. Zalma-Puxico Rd., Route 51, Sect. 29, $14,173; 4.106 mi. Sect. 33, same road $23,878; 4.239 mi. Sect. 34 same road, $27,447, all Stoddard Co. — to Pioneer Constr. Co., 270 Glover Bldg., Kansas City, 2.61 mi. Sect. 2, Evona-McFall Rd., $11,773; 2.509 mi. Sect. 3 same road $12,107, both Gentry Co.—to M. E. Gillioz, Monett, 3.731 mi. Crites-Corner to Ripley Co. Rd., Route 21, Sect. 42, $28,333; 3.132 mi. Sect. 43 same road $30,176; 0.944 mi. Sect. 44A same road $2,205, all foregoing Ray Co.; 4.492 mi. Caldwell Co.-Richmond Rd., Sect. 235A, $27,038; 4.163 mi. Sect. 335B same road $39,097; 4.228 mi. Sect. 335C same road $31,533; 4.161 mi. Sect. 335D same road, $37,080, all foregoing Ray Co.; 4.71 mi. Coldwater-Silva Rd., Route 67, Sect. 9, $56,321; 4.811 mi. Sect. 10 same road $55,729, both Wayne Co.—to Samples & Elsea, Kirksville, 1.3 mi. Pike Co. $9,561; 4.308 mi. Lincoln Co. $7,352—to Richmond Constr. Co., Advance, 2.977 mi. Dunkin Co. $14,200; 1.066 mi. Route SN, Sect. 1, $2,829; 1.982 mi. Sect. 3 $7,502, both Scott Co.—to C. Spitzcaufsky, 1918 Baltimore Ave., Kansas City, 3.222 mi. Route ST, Sect. 1, $14,353; 3.576 mi. Route ST, Sect. 3, $16,601, both Camden Co.—Knutson Bros., 3520 Main St., Kansas City, 1.839 mi. Sullivan Co., $12,778; grading 4.506 mi. Green Castle-Navinger Rd., Route 6, Sect. 340D, $53,359; 4.6 mi. Sect. 340C same road $37,469, both Adair Co.—to P. J. Murphy, Moberly, 1.61 mi. Boone Co. $3,699; 1.989 mi. Fayette-Harrisburg Rd., Route SC, Sect. 3, $6,767; 1.599 mi. Route SC, Sect. 5, $3,299, both Howard Co.—to M. N. Penny, Lawrence, Kan., grading, concrete paving 1.056 mi. Iowa Line-Rockport Rd., Route 1, Sect. 309A, $7,544; 4.899 mi. Sect. 309B same road $34,631; 1.655 mi. Sect. 309C same road $12,287; 4.76 mi. Sect. 309D same road $34,029; 4.404 mi. Sect. 309E same road $31,236, all foregoing in Atchison Co.—to Davis Constr. Co., Inc., Booneville, 1.995 mi. Waverly-Marshall Rd., Sect. 278A, Lafayette Co., $13,170; 4.06 mi. Sect. 278B same road $26,630; 4.37 mi. Sect. 278C same road $24,551; 4.598 mi. Sect. 278D same road $29,767; 3.971 mi. Sect. 16B same road $26,064, all foregoing Saline Co. — to Chaney & Amyx, Branson, grading, graveling, concrete paving 3.233 mi. Rogersville-Fordland Rd., Webster Co. $28,660; grading 2.294 mi. Centerville-Black Rd., Route SA, Sect. 1, Reynolds Co. $15,826. Grand total $1,044,266. Noted Jan. 11.

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N. Y., Brooklyn—H. Hesterberg, pres. Brooklyn Boro, Boro Hall, to J. and M. Moran, 413 Sterling Pl., regulating, Albany Ave., $2,184; East 91st St., $2,929; Glenwood Rd., $3,328—to A. Suriano, foot 24th St., East 31st St., $2,019; Milford St., $3,524—to Grimm Contg. Co., 170 McKinley Pl., Elmore Pl., $2,028—to Pomonok Asphalt Paving & Building Material Co., 1246 Grand St., asphalt paving New Lots Ave., $9,258. Grand total $25,388. Noted Jan. 22.

N. C., Greensboro—Sheet asphalt paving 1⅛ mi. West Market St. from Northridge to Holden Rd., to Murray Constr. Co., 508 Union Ave., Knoxville, Tenn.

Oklahoma—State Hy. Dpt., Oklahoma City, grading, drainage structures 12.108 mi. roads in Woods Co., to Humphrey & Thomas, Security Bldg., Omaha, Neb., $30,000 est. $35,000; 11.38 mi. Texas Co., to Allhands & Davis, Joplin, Mo., $37,259 est. $42,000, both 32 ft. wide.

Oklahoma—State Hy. Dpt., Oklahoma City, grading, drainage structures 12.23 mi. roads in Washita Co. and 2.21 mi. Custer Co., to J. L. Vilbig, 2517 Eakin St., Dallas, Tex., $108,308 and $21,126 respectively est. $115,000 and $25,000 respectively—7.059 mi. Rogers Co., to J. E. Smith & Sons, Noble, $34,140 est. $36,000—9.148 mi. Grant Co., to Maney & Alley, Empire Bldg., Oklahoma City, $39,424 est. $45,000—7.754 mi. Hughes Co., to Green Constr. Co., 519½ West Main St., Oklahoma City, $47,213 est. $50,000. Grand total $250,211. Noted Jan. 29.

Oklahoma — State Hy. Dpt., Oklahoma City, grading, drainage structures 7 mi. Vinita Rd., and 6.48 mi. Welch Rd., Craig Co., to J. H. Maxwell, 2 North Boston St., Tulsa, $36,738 and $29,675 respectively, est. $35,000 each—6 mi. Federal Aid Project 206-F and 5.52 mi. Sect. E same road, Roger Mills Co., to Richards & Moorman, Majestic Bldg., Oklahoma City, $28,488 and $23,710 respectively, est. $30,000 and $25,000 respectively—7 mi. North Maniteau Rd. and 6.98 mi. South Maniteau Rd., Tillman Co., to J. S. Wade & Sons, Edmond, $33,746 and $30,246 respectively, est. $35,000 and $33,000 respectively—5.57 mi. Woods Co., to F. Walke, Enid, $25,816 est. $27,000—8.455 mi. Cotton Co., to W. L. James, Hugo, $37,563 est. $40,000—4.33 mi. Kiowa Co., to Mervelt & Lawson, El Reno, $19,084 est. $25,000. Grand total $265,056. Noted Jan. 29.

Tennessee—State Dpt. Hys. & P. Wks., City Hall, improving 5.908 mi. roads in Henderson Co., to McDade & McDade, Livingston, Ky., $61,458 — 7.326 mi. Lawrence Co., to W. F. Bowe, Jr., 541 Broad St., Atlanta, Ga., $211,999 — 4.937 mi. Federal Aid Project 248-A, Sevier Co., and 3.693 mi. same road, Sect. B, to Chandler Bros., Virgilina, Va., $135,551 and $107,253 respectively—Obion Co., to Frazier, Davis Constr. Co., Arcade Bldg., St. Louis, Mo., $51,477—2 bridges over 20 ft. span, to A. Lyons, Rogersville, $26,087. Grand total $593,915. Noted Jan. 15.

Tex., La Feria—See "Waterworks."

Utah—State Rd. Comn., Salt Lake City, grading, surfacing 4.589 mi. Basin Hy. between Duchesne and Fruitland, Duchesne Co., to J. LaRue Ogden Co., Richfield, $53,978. Est. $62,489. Noted Jan. 29.

Utah, Salt Lake City—City Comn., City Hall, curbing, guttering, bituminous concrete paving West Temple and 17th South Sts., to Gibbons & Reed Co., Kearns Bldg., $82,539. Est. $84,518. Noted Jan. 29.

W. Va., New Cumberland—Hancock Co., concrete surfacing 1.9 mi. Holidays Cove Rd., 18 ft., to Wierton Constr. Co., Wierton, $100,283.

Wis., Milwaukee—Bd. P. Wks., paving West Keefe Ave., to Gumz & Switalski, 831 13th Ave., $61,995—West Port Washington Rd., to W. F. Hunt, 757 North Bway., $3,009—West Lisbon Ave., to Badger Constr. Co., 97 East Wisconsin Ave., $21,416—West Forest Home Ave., to White Constr. Co., 68 East Wisconsin Ave., $35,001. Grand total $121,421.

EXCAVATION, DRAINAGE, IRRIGATION, LEVEES, RIVER AND HARBOR

PROPOSED WORK

Calif., Los Angeles—Los Angeles Co. Alamitos Bay Project, incl. channel, levees, jetties, dredging, 500,000 cu.yd. excav., also 1 rein.-con., 2 pile trestle bridges. $750,000. E. C. Eaton, ch. engr. Los Angeles County Flood Control Dist.

Ind., Washington—Bd. Comrs. Daviess Co., 27 mi. levee work, incl. 1,375,000 cu.yd. excav., 41 flood gates. $215,045. W. J. Shanks, Washington, engr.

Ia., Sioux City — Reynolds Creek Drainage Dist., preliminary surveys drainage work. $20,000. E. L. Ferguson, 512 U. B. Bldg., Sioux City, engr.

Michigan — Drainage Bd., Port Huron, soon takes bids constructing south branch of Mill Creek in St. Clair, Lapeer and Sanilac Counties, incl. 14 mi. open ditches, 919,932 cu.yd. excav. $262,000. E. R. Whitmore, Boynton Blk., Port Huron, engr.

Mississippi — Bear Creek Drainage Dist., Humphreys, Leflore and Sunflower Counties, 9,000,000 cu.yd. ditches, 1,000,000 cu.yd. levees. **Maturity about Mar. 1.** C. E. Miller, Belzoni, engr.

Tex., Brownwood—Brown Co. Water Impvt. Dist. 1, furnishing, erecting large pumping system for pumping water from large irrigation canal into irrigation lines in district and pumping water into main lines of municipal water system; 15 mi. pipe lines for distributing water for irrigating 10,000 acre tract of land between city and storage reservoir (now under construction); constructing 5 mi. canal in connection with storage reservoir (now under construction). Noted Sept. 18.

BIDS ASKED

Calif., El Nido — Feb. 25, by A. L. Cowell, secy. El Nido Irrigation Dist., 11.2 mi. main canal, incl. 111,000 cu.yd. excav., 18.6 mi. dist. laterals, incl. 88,000 cu.yd. excav., drilling 3 drainage wells, furnishing pumping equipment, constructing syphons, drops, steps, gates, bridges. G. E. Winton, Shaffer Bldg., Merced, engr.

Calif., Orange—See "Waterworks."

Ill., Pekin—Feb. 23, by Bd. Comrs. Tazewell Co., drainage work in Union D.D. 1, incl. 2.5 mi. ditches, 1,200 cu.yd. excav. R. P. Van Deusen, Jesse Blk., engr.

Ind., Noblesville—Feb. 21, by J. S. Shannon, supt. constr., repairing, extending, T. J. Patterson Drain, Fall Creek Twp., Hamilton Co.

La., New Orleans—Mar. 10, by Bd. Comrs. Lake Borgne Basin Levee Dist., at office State Engineer, New Orleans Court Bldg., Jackson Levee, St. Bernard Parish, incl. 300,000 cu.yd. excav.

Mich., Flint—Feb. 27, by A. H. Reid, drain comr. Genesee Co., constructing Swartz Creek and Crapo drain cleanout, Crapo Farm, Sect. 3, incl. 43,932 cu.yd. open work, in Gaines Twp.

N. J., Beach Haven—Feb. 21, by Beach Haven Yacht Club, F. O. Runyan, chn., Fire House, 225 ft. timber bulkhead, 340 ft. pier, 10 ft. wide with a tee end 20 ft. long, 10 ft. wide, also dredging 25,000 cu.yd. and channel. $25,000. H. T. Greene, Toms River, engr.

N. J., Longport — Feb. 21, by Bd. Boro Comrs., Boro Hall, stone jetties on ocean front off 20th Ave. $25,000. E. D. Rightmire, boro engr.

N. J., Newark—Mar. 2, by State Hy. Comn., Trenton, rein.-con. retaining walls on precast concrete piles, accompanying embankment on Route 29, Sect. 10A between Meeker Ave. and Empire St. A. L. Grover, ch. clk.; adv. E. N.-R. Feb. 19.

N. Y., New York—Feb. 26, by M. Cosgrove, comr. Docks Pier "A," Battery Pl., dredging, removing rock and overlying material south side Pier 3, North River, Manhattan Boro.

Tex., Harlingen — Mar. 2, by A. Tamm, engr., 209½ West Jackson St., and Cameron Co. Water Impvt. Dist. 1, Harlingen, 300,000 sq.ft. canal lining. $100,000.

Ont., Ottawa — Secretary Bd. Control bids about Mar. 1, flood prevention work on Rideau River. $100,000. A. F. Macallum, city engr.

CONTRACTS AWARDED

Ala., Birmingham—A. J. Hawkins, city engr., Sect. 3, Village Creek Drainage Project from Avenue W, Ansley to 10th St., W. in East Thomas, to Ward Hayes Constr. Co., Mound City, Ill., $138,555. Noted Dec. 25.

Fla., Miami—Virginia Key Development Co., Miami, dipper dredging 80,000 to 100,000 cu.yd., to Clark Dredging Co., Miami.

Ind., Hammond—Lake Co., constructing Dyer Ditch 2, St. Johns Twp., incl. 17,500 ft. open ditch, 23,016 cu.yd. excav., to A. Eckert, San Pierre.

Ind., Valparaiso—Porter Co., Lewis Keller Ditch, incl. 27,670 cu.yd. excav., to W. C. Babcock Co., Rensselaer.

Ind., Washington—Daviess Co., J. F. McGee Ditch, in Van Buren Twp., incl. 43,084 cu.yd. excav., to D. E. and W. Alumbaugh, Sullivan.

Ind., Winchester—Randolph Co., constructing O. O. Hinshaw Ditch, incl. 2,533 cu.yd. excav., to O. O. Hinshaw, Winchester; tile, to Portland Drain Tile Co., Portland.

La., New Orleans—Bd. Comrs. Orleans Levee Dist., 606 Common St., concrete retaining wall and auxiliaries, for airport, to Fuller Constr. Co., 8217 Palmetto St. $951,521. Noted Jan. 22.

Mo., Richmond—Sunshine Levee Dist. levee construction to C. S. Wright, Carrollton, $25,035.

Bond Elections

Coming Bond Elections

Waterworks—Brawley, Calif., $60,000.
Reservoir—Hornell, N. Y., Mar. 11, $70,000.
Sewers—Gretna, La., Feb. 18, $150,000.
Storm Sewerage System — Springfield, Mo., $700,000.
Court House — Wellington, Tex., Collingsworth County, Feb. 21, $175,000.

Bonds Voted

Waterworks Impvts. — Chickasha, Okla., $190,000. R. O. Bradley, Engr.
Waterworks — Martin, S. D., $32,000. Dakota Engr. Co., Mitchell, Engrs.

FEDERAL GOVERNMENT

PROPOSED WORK

Calif., Mare Island—BATTERY STORAGE—Spec. 6431—Yards & Docks, Navy Dpt., battery storage and overhaul building. $240,000.

Calif., San Diego—BARRACKS—Spec. 6370—Yards & Docks, Navy Dpt., 4 barracks. $400,000.

Calif., San Diego—BARRACKS—Spec. 6419—P. Wks. Office, Navy Yard, barracks for enlisted men at Naval Training Station.

Calif., San Diego—DREDGING, etc.—Specs. 6399 and 6400—Yards & Docks, Navy Dpt., dredging, $60,000; quaywall, $150,000.

Calif., San Diego—DRY DOCK—Spec. 6352—Yards & Docks, Navy Dpt., floating dry dock. $425,000.

Calif., San Diego—GAS TANKS—Spec. 6425—Yards & Docks, Navy Dpt., gas tank. $40,000.

Conn., New Haven—DREDGING—U. S. Eng., Providence, R. I., 350,000 cu.yd., in Quinnipiac River.

Conn., Newington—RECREATION—Vet. Bu., Arlington Bldg., recreation building at U. S. Veterans Hospital. $170,000.

D. C., Wash.—BOILERS—Spec. 6389—Yards & Docks, Navy Dpt., installing boilers, stokers. $110,000.

Fla., Pensacola—DRAINAGE SYSTEM, etc.—Spec. 6424—Yards & Docks, Navy Dpt., drainage system, improving taxiway. $100,000.

Ga., Fort Benning—QUARTERS—Con. Q. M. brick quarters, for medical officers, concrete found.

Idaho, Weiser—FEDERAL—Treas. Dpt. at office Sup. Archt., U. S. Federal Building. $110,000 funds allocated.

Ind., Greensburg—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, Franklin and North Sts.

Ind., Lafayette—POST OFFICE—Treas. Dpt. at office Sup. Archt., plans by W. Scholer, Lafayette, federal building. Noted Jan. 29.

Mass., Rutland — HOSPITAL — Vet. Bu., Arlington Bldg., hospital at U. S. Veterans Hospital. $410,000.

Nev., Hawthorne—RESERVOIR—Spec. 6329—Yards & Docks, Navy Dpt., reservoir at Naval Ammunition Depot. $150,000.

N. H., Portsmouth—CRANE—Spec. 6438—Yards & Docks, Navy Dpt., electric bridge crane. $50,000.

N. J., Lakehurst—BARRACKS—Spec. 6390—Yards & Docks, Navy Dpt., barracks and quarters. $340,000.

N. Y., New York—FEDERAL COURT—Treas. Dpt. at office Sup. Archt., federal court building, 505 Pearl St. **Maturity about May 1.** Noted Feb. 12.

Pa., Phila.—RUNWAY—Spec. 6426—Yards & Docks, Navy Dpt., rebuilding seaplane runway. $75,000.

Va., Norfolk — BUILDINGS — Spec. 6422 — Yards & Docks, Navy Dpt., altering buildings. $150,000.

T. H., Pearl Harbor—ENGINE OVERHAUL SHOP—Yards & Docks, Navy Dpt., engine and aircraft overhaul shop. $220,000.

T. H., Pearl Harbor—TRAINING TANK, etc.—Specs. 6371 and 6372—Yards & Docks, Navy Dpt. submarine escape training tank; runway bulkhead and paving $100,000.

BIDS ASKED

Arkansas—LEVEE—Mar. 10, by U. S. Eng., P. O. Box 667, Vicksburg, Miss., 3,015,500 cu. yd. in Pendleton Enlargement, Davis Lake Levee, Medford New Levee, Medford Enlargement, McKennon Enlargement and in Redfork New Levee, south bank Arkansas River.

Ariz., Tucson—HOSPITAL—Mar. 23, by Vet. Bu., Arlington Bldg., patient's building at U. S. Veteran's Hospital; adv. E. N.-R. Feb. 19. Noted Feb. 5.

California — ROAD — Feb. 26, by C. H. Sweetser, dist. engr. Pub. Rds., 461 Market St., San Francisco, Calif., grading 10.932 mi. Sect. A, Route 11, Lava Beds National Forest Hy., Modoc Co.

Calif., San Francisco—TRACTOR—Feb. 24, by Quartermaster Supply Officer, Fort Mason, 4 wheel, gasoline propelled industrial tractor, with 24 hp. motor, 4 speeds forward and 1 reverse; four 5 ton capacity steel frame, heavy duty trailers, wood platform, with 4 cast steel wheels with roller bearings; 3,000 lb. spur gear drive, 4 wheel steer, 2 wheel drive, 2 speeds forward and reverse.

Calif., San Diego — STORE HOUSE — Spec. 6407 — Mar. 18, by Yards & Docks, Navy Dpt., store house. $150,000.

Colorado — ROAD — Mar. 3, by Pub. Rds., grading, draining 4 mi. Six Mile Creek Natl. Forest Hy., Pike National Forest, Jefferson Co. A. E. Palen, 301 Customs House Bldg., Denver, dist. engr.

Colorado—ROAD—Mar. 12, by Pub. Rds., Custom House, Denver, grading 7.871 mi. Berthoud Pass Natl. Forest Rd., Arapahoe and Pike National Forests, Grand and Clear Creek Counties. A. E. Palen, 301 Customs House Bldg., Denver, dist. engr.

Conn., New Haven—DREDGING—Mar. 4, by U. S. Eng., Providence, R. I., 347,600 cu.yd. New Haven Harbor; adv. E. N.-R. Feb. 19.

D. C., Wash.—COMMUNICATION STATIONS—See "Contracts Awarded."

D. C., Wash.—PONTOONS—Mar. 3, by U. S. Eng., 1068 Navy Bldg., constructing, testing and delivering 41 steel pontoons; adv. E. N.-R. Feb. 19.

Ill., Belleville—BARRACKS—Mar. 3, at office Con. Q. M., Scott Field, 1 air corps barracks; adv. E. N.-R. Feb. 19.

Ill., Belleville—QUARTERS—Mar. 10, at office Con. Q. M., 8 double sets non-commissioned officers quarters; adv. E. N.-R. Feb. 19.

Ill., Carbondale—POST OFFICE—Mar. 18, by Treas. Dpt. at office Sup. Archt., U. S. Post Office; adv. E. N.-R. Feb. 19.

Ind., Fort Benjamin Harrison—CLUB—Mar. 10, at office Con. Q. M., service club; adv. E. N.-R. Feb. 19.

Md., Fort Meade—QUARTERS—Mar. 12, at office Con. Q. M., Fort George G. Meade, 15 sets company officers quarters; adv. E. N.-R. Feb. 19.

Mass., Boston—ELECTRIC FURNACE—Feb. 24, by Yards & Docks, Navy Dpt., electric furnace, for Navy Yard.

Mass., Boston—POST OFFICE—Feb. 28, by Treas. Dpt. at office Sup. Archt., 21 story, basement, sub-basement, granite post office, Post Office Sq. $6,000,000. Former bids rejected. Noted Dec. 18.

Mass., Hingham—DREDGING ,etc.—Feb. 23, by Yards & Docks, Navy Dpt., Boston, dredging, bulkhead, rebuilding pier at Naval Ammunition Depot.

Mississippi—LEVEE—Mar. 10, by U. S. Eng., P. O. Box 667, Vicksburg, 3,051,000 cu.yd. earthwork in Denis Landing Enlargement and new levee, Ashbrook to Tarpley Enlargement Sect. 2, Greenville Front Levee and Warfield to Refuge Levee, on east bank Mississippi River.

Mont., Babb-Piegan—INSPECTION STATION—Mar. 16, by Treas. Dpt. at office Sup. Archt., constructing U. S. Inspection Station Building.

Neb., York — POST OFFICE — Mar. 9, by Treas. Dpt. at office Sup. Archt., enlarging, remodeling U. S. Post Office.

N. H., Portsmouth—CRANE—Feb. 20, by Yards & Docks, Navy Dpt., electric traveling crane for Navy Yard.

N. J., Camden — ELEVATORS — Mar. 4, by Treas. Dpt. at office Super. Archt., elevators for U. S. Post Office.

N. Y., Albany — DREDGING — Mar. 3, by U. S. Eng., 710 Army Bldg., 39 Whitehall St., New York, 515,300 cu.yd. in Hudson River near North Germantown, 37.25 mi. south of here; 119,200 cu.yd. at Heath, about 48.5 mi. south of here; adv. E. N.-R. Feb. 19.

N. Y., Brooklyn—CABLE—Mar. 10, by Signal Supply Officer, Signal Sect., New York General Depot, Army Base, cable.

N. Y., Brooklyn—CONDUIT—Feb. 20, by Signal Supply Officer, Signal Sect., New York General Depot, Army Base, conduit.

N. Y., Brooklyn—DISPENSARY—See "Contracts Awarded."

N. Y., Brooklyn—LUMBER—Feb. 24, by Signal Supply Officer, Signal Sect., New York General Depot, Army Base, Brooklyn, lumber.

N. Y., Brooklyn—POWER PLANT—Feb. 25, by Navy Dpt. P. Wks. Dpt., Brooklyn Navy Yard, power plant addition, incl. turbo-alternator, at Brooklyn Navy Yard. $80,000.

N. Y., Sodus—BREAKWATER—Feb. 24, by U. S. Eng., Federal Bldg., Buffalo, repairing and reconstructing 215 lin.ft. timber-crib substructure and constructing thereon concrete superstructure for east breakwater, Great Sodus Bay Harbor.

N. C., Greensboro — POST OFFICE — Treas. Dpt. at office Sup. Archt., bids about Apr. 1, U. S. Post Office, West Market and North Eugene Sts. Noted June 5.

O., Massillon—REMODELING, etc.—Feb. 27, by Treas. Dpt. at office Sup. Archt., remodeling, enlarging U. S. Post Office.

O., Wright Field (mail Dayton)—HANGAR—Feb. 27, by R. M. Jones, contg. officer U. S. Air Corps., 1 story, steel, concrete hangar.

Pa., Phila.—SHOP—Spec. 6415—Mar. 4, by Yards & Docks, Navy Dpt., extension to shop building, Marine Corps. $200,000.

Pa., Pittsburgh—DREDGING—Mar. 18, by U. S. Eng., 57,700 cu.yd. in Monogahela River; adv. E. N.-R. Feb. 19.

R. I., Newport—HOSPITAL—Spec. 6403—Mar. 4, by Yards & Docks, Navy Dpt., extending main building at Naval Hospital. Noted Feb. 12.

R. I., Warren—POST OFFICE—Mar. 10, by Treas. Dpt. at office Sup. Archt., U. S. Post Office. Noted Jan. 29.

S. D., Pierre — SCHOOL — Mar. 5, by Commissioner Indian Affairs, constructing and equipment school.

Tex., Fort Sam Houston — RECLAMATION BUILDING — Mar. 5, by Con. Q. M., oil reclamation building.

Tex., Huntsville—POST OFFICE—Mar. 12, by Treas. Dpt. at office Sup. Archt., U. S. Post Office.

Tex., Randolph Field — ELECTRIC DISTRIBUTION SYSTEM—Mar. 3, by Con. Q. M., constructing, installing electric distribution system; adv. E. N.-R. Feb. 19.

Tex., Randolph Field—QUARTERS—Mar. 6, at office Con. Q. M., 11 field officers quarters; adv. E. N.-R. Feb. 19. Noted Jan. 29.

Tex., Randolph Field—QUARTERS—Mar. 11, by Con. Q. M., 7 company officers quarters; adv. E. N.-R. Feb. 19.

Virginia and Maryland — DREDGING — Feb. 20, by U. S. Eng., 300 Custom House, Baltimore, Md., 4,073 cu.yd. at mouth Nandua Creek, Va.; 38,690 cu.yd. at mouth Occobannock Creek, Va.; 33,440 cu.yd. from waterway from Tangier South to Ewell (Smith Island, Md.); 41,490 cu.yd. Elk River, Md.; adv. E. N.-R. Feb. 19.

Va., Hampton Roads — QUARTERS — Spec. 6404—Mar. 4, by Yards & Docks, Navy Dpt., constructing tugs' crews quarters at Naval Operating Base.

Va., Hampton Roads—HANGAR—Spec. 6405—Mar. 11, by Yards & Docks, Navy Dpt., 160 x 203 ft. extension to hangar and shop building.

Va., Quantico — BOILER PLANT — Spec. 6408—Mar. 18, by Yards & Docks, Navy Dpt., boiler plant.

Wis., Milwaukee—TRANSMISSION CABLES—Mar. 2, by Superintendent Lighthouses, electric power transmission cables, 24,200 ft. wire armored submarine type, 4,000 volt service; 1,500 lead and steel tape Park type, 4,000 volt service; 1,500 ft. lead and steel tape, Park type, 440 volt service, electric low voltage control and telephone cable; 24,200 ft. wire armored submarine type, 1,500 ft. lead and steel taped Park type; adv. E. N.-R. Feb. 19.

Wyoming—ROAD—Apr. 1, by Pub. Rds., 301 Custom House, Denver, Colo., grading, drainage 12.41 mi. Hoback Canyon Natl. Forest Rd., Teton Natl. Forest, Sublette Co. A. E. Palen, Denver, Colo., dist. engr.

CONTRACTS AWARDED

Ala., Montgomery—PAINT WAREHOUSE—Con. Q. M., paint, oil and dope warehouse, maintenance building, warehouse and garage, to Smith-Pew Constr. Co., Atlanta, Ga., $81,890 Noted Jan. 29.

Ariz., San Luis—INSPECTION STATION—Treas. Dpt. at office Sup. Archt., inspection station, to Modern Constr. Co., 3308 Kettner Blvd., San Diego, $44,757. Noted Nov. 20.

California—ROAD—C. H. Sweetser, dist. engr. Pub. Rds., 461 Market St., San Francisco, grading, crushed rock surfacing 4.144 mi. Sect. E, Shady Flat to Downieville Rd., Yuba Pass Natl. Forest Hy., Sierra Co., to C. R. Adams, Nevada City, $123,159. Noted Jan. 8.

Conn., Hartford — TEST BORINGS — Treas. Dpt. at office Sup. Archt., test borings, post office, court house, to Gow Co., Park Sq. Bldg., Boston, Mass. at $0.50 per ft. Noted May 15.

D. C., Wash.—COMMUNICATION STATIONS—Dpt. Commerce, Bureau Lighthouses, Airways Div., 1 story, frame building to house 2 kw. broadcast transmitter and ¼ kw. high frequency transmitter supported by two 125 ft. steel towers set 450 ft. apart, at Little Rock, Ark., Birmingham, Ala., Shreveport, La., Jackson, Miss., Jacksonville, Fla., Eutawville, S. C., and Amarillo, Tex., also a radio range beacon, incl. 1.5 kw. unit power and 5 kw. 500 cycle motor generator, at Little Rock, Ark., own forces, under supervision Dpt. Engineers.

Illinois—LOCK and DAM—U. S. Eng., 1st Chicago Dist., 333 North Michigan Ave., Chicago, completing construction Brandon Road Lock and Dam, on Des Plaines River, to Connolly Contg. Co., 2234 University Ave., St. Louis, $415,350. Noted Jan. 8.

Ind., Decatur—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, to Anderson Constr. Co., 1966 Lawrence St., Chicago, Ill. Noted Dec. 25.

Ind., Muncie—POST OFFICE—Treas. Dpt. at office Sup. Archt., remodeling U. S. Post Office, to Ideal Constr. Co., Gary, $100,000. Noted Jan. 22.

Massachusetts — DREDGING — U. S. Eng., Providence, R. I., 1,300,000 cu.yd. in New Bedford and Fairhaven Harbors, to Great Lakes Dredge & Dock Co., 17 Battery Pl., New York, at $0.1975 per yd., total $262,750. Noted Jan. 15.

Md., Perry Point—CONVALESCENT BUILDING — Vet. Bu., Arlington Bldg., convalescent building at U. S. Veterans Hospital, to Adams Constr. Co., 217 Clarkson Court, Chicago, Ill., $189,925. Noted Jan. 8.

Minn., Minneapolis—LOCK—U. S. Eng., St. Paul, 2nd lock at U. S. Government Dam in Mississippi River between Minneapolis and St. Paul, to A. Guthrie & Co., Builders Exch. Bldg., St. Paul, $683,599. Noted Jan. 22.

Missouri — LEVEE — U. S. Eng., Memphis, Tenn., 215,000 cu.yd. in Item 22D and 115,000 cu.yd. in Item 22E, in Lower St. Francis Levee Dist., near Stewart, Mo., to J. J. McCaughey Constr. Co. & States Contg. Co., 205 West Wacker Dr., Chicago, Ill., $79,550 and $41,400 respectively; 110,000 cu.yd. Item 22H and 110,000 cu.yd. 22-I, to R. B. Potashnick, Cape Girardeau, $70,400; 100,000 cu.yd. Item 22J and 100,000 cu.yd. Item 22K, to M. T. Lee, Charles, $72,000. Grand total $263,350.

N. Y., Brooklyn—DISPENSARY, etc.—U. S. Navy, Dpt. P. Wks., Brooklyn Navy Yard, dispensary, improving Building 28, improving roofs, day labor. $165,000.

N. Y., Buffalo—BREAKWATER—U. S. Eng., Buffalo, repairing 622 lin.ft. breakwater at Dunkirk Harbor to Great Lakes Dredge & Dock Co., Morgan Bldg., Buffalo, $40,582. Noted Jan. 1.

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Federal Government (Continued)

N. Y., Fort Wadsworth (mail Staten Island)—QUARTERS—Con. Q. M., 2 double sets noncommissioned officers quarters, to J. A. Moraw & Owens, 2474 27th St., Long Island City, $29,443. Noted Jan. 1.

N. Y., New York—DREDGING—U. S. Eng., Army Bldg., 30 Whitehall St., 16,745 cu.yd. ledge rock and 7,225 cu.yd. material other than ledge rock in Harlem River, to Bridgeport Dredge & Dock Co., 475 5th Ave. Noted Dec. 11.

South Carolina—DREDGING—U. S. Eng., Charleston, Shipyard River, Charleston Harbor, to P. Sanford Ross, Inc., 277 Washington St., Jersey City, N. J. Est. $18,992. Noted Jan. 1.

W. Va., Charleston—LOCK—U. S. Eng., Huntington, Marmet Lock, appurtenances on Great Kanawah River, 9 mi. above here, to General Contg. Co., Columbia Bldg., Pittsburgh, Pa., $799,642. Noted Jan. 8.

Wyo., Green River — POST OFFICE — Treas. Dpt. at office Sup. Archt., U. S. Post Office, to E. E. Garber, 203 West 4th St., Bethlehem, Pa., $63,310. Noted Jan. 1.

RAILWAYS

BIDS ASKED

Texas—Emery, Peck & Rockwood Development Co., Marble Falls and Austin, taking bids 1¼ mi. single track line, incl. rock excavating and fill, for railway line from near Burnet to Austin - Llano Southern Pacific Ry. line in Marble Falls. Owner does most of work. Total $75,000. Noted Jan. 29.

CONTRACTS AWARDED

Michigan—Dpt. Water Supply, 735 Randolph St., Detroit, D. C. Grobbel, acting secy., grading, laying railroad tracks connecting new power plant of Springwell Station with main railroad in Detroit, to Armond Cassil, Inc., 5-107 General Motors Bldg., Detroit. Est. $25,000. Noted Jan. 22.

New Jersey—Bd. City Comrs., City Hall, Newark, constructing city railway in Morris Canal Beds, in Newark, to Thomas Crimmins Contg. Co., 734 Lexington Ave., New York, $1,763,284. Noted Dec. 4.

Quebec—Canadian Natl. Rys., C. B. Brown, ch. engr. (oper.), 315 Insurance Exch. Bldg., Montreal, grading for railway, between Longue Pointe to Eastern Jct., Montreal, to Kennedy Constr. Co., 407 McGill St., Montreal, Que. Est. $1,000,000.

TUNNELS AND SUBWAYS

CONTRACTS AWARDED

Que., Montreal—City, subway under Canadian Pacific R.R., St. Hubert St., to Atlas Constr. Co. Ltd., 679 Belmont St., $165,278. Noted Nov. 27.

Que., Montreal—City, J. E. Gauthier, clk., 74 x 900 ft. rein.-con., steel subway, 54 ft. roadway under Canadian Pacific R.R., Decarie Blvd., to Quebec Paving Co., 411 Canada Cement Bldg., $156,906.

Que., Montreal—City Council awarded contract for Wellington St. Tunnel under Lachine Canal, cost plus 10%, to Dufresne Constr. Co., 1832 Blvd. Pix IX. Est. $2,556,000.

GRADE CROSSINGS

PROPOSED WORK

Massachusetts — Commonwealth of Massachusetts, State House, Boston, Boston & Maine R.R., W. J. Backes, ch. engr., Boston, and respective cities, grade crossing overpass, Beaver Brook and Main Sts., in Waltham, est. $500,000; New Boston Rd., in Winchendon, $80,000 — State St. in Newbury, $150,000. A. W. Dean, Dpt. P. Wks., State House, Boston, engr.

Mass., Ayer — Commonwealth of Massachusetts, Dpt. P. Wks., State House, Boston, City of Ayer and Boston & Maine R.R., W. J. Backes, ch. engr., Boston, grade crossing, over or underpass, Main St. $300,000. A. W. Dean, Dept. P. Wks., Boston, engr.

Mass., Littleton — Commonwealth of Massachusetts, town and Boston & Maine R.R., W. J. Backes, ch. engr., Boston, grade crossing —overpass, State Rd. Town Way. $150,000. A. W. Dean, Dept. P. Wks., State House, Boston, engr.

N. J., Hasbrouck Heights—Erie R.R. Co., G. S. Fanning, ch. engr., 50 Church St., New York, and State Hy. Comn., Trenton, bids after June 1, eliminating Williams Ave. grade crossing, at Williams Ave. $250,000.

N. Y., Eden—Erie R.R. Co., G. S. Fanning, ch. engr., 50 Church St., New York, reconstructing bridge over Hamburg-North Collins County Hy. $95,000. **Maturity indefinite.**

O., Dayton—City and Baltimore & Ohio R.R., A. H. Griffith, asst. to ch. engr., Cincinnati, eliminating grade crossings in North Dayton on Baltimore & Ohio R.R., as part of general grade separation project. Total $2,500,000. City will issue $800,000 in bonds to finance its share of cost.

CONTRACTS AWARDED

Tex., Fort Worth—Texas & Pacific R.R., E. F. Mitchell, ch. engr., Dallas, rein.-con. underpass under railroad, South Main St., to H. K. McCallum, Fort Worth Natl. Bank Bldg., $138,050.

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Ont., Hamilton—Toronto, Hamilton & Buffalo Ry. Co., Hamilton, R. L. Latham, ch. engr., James and Hunter Sts., and 5 subways, to Dominion Constr. Co., Reford Bldg., Toronto, $1,500,000. Noted Jan. 29.

DAMS

BIDS ASKED

Calif., Orange—See "Waterworks."

CONTRACTS AWARDED

B. C., Kasle—See "Power Plants."

PIERS AND WHARVES

PROPOSED WORK

Tex., Beaumont — WHARF — City, c/o P. Millard, mgr., 1,100 ft. new wharf, 36 ft. wide, incl. loading and unloading machinery. $600,000. R. C. Black, city engr.

BIDS ASKED

Calif., Oakland—PIER SUPERSTRUCTURE—City of Oakland Port Comn., Bank of Savings Bldg., taking bids steel superstructure for terminal foot Webster St. Noted Feb. 12.

N. Y., New York—PIER—Feb. 25, by M. Cosgrove, comr. Docks, Pier "A," foot Battery Pl., North River, constructing Pier 32.

CONTRACTS AWARDED

Mass., Boston—PIERS—City, Dept. P. Wks., repairing piers at North and South Ferries, to W. H. Ellis & Sons Co., 479 Meridian St., East Boston, $13,810.

AIRPORTS

CONTRACTS AWARDED

Conn., New Haven—City, Municipal Airport Comn., general contract airport, incl. brick, rein.-con. administration, fire, storage and service buildings, to Fusco & Amatruda, 59 Amity Rd., $32,700; lights and flood lighting, to Stevens Fitch Co., Meadow St. Noted Jan. 29.

La., New Orleans—See "Excavation, Drainage, Irrigation, Levees, River and Harbor."

N. Y., Brooklyn—M. Cosgrove, comr. Docks, Pier "A," Battery Pl., North River, administration building Municipal Airport (Floyd Bennett Field), to Longacre Eng. Co., 345 Madison Ave., New York, $258,500. Noted Jan. 29.

GRAIN ELEVATORS

PROPOSED WORK

Ia., Sioux City—GRAIN ELEVATOR—Farmers Union Co-operative Grain Assn. of South Dakota, J. S. Atkins, pres., Wessington, Springs, S. D., preliminary plans 500,000 bu. grain elevator, rein.-con. $75,000.

BIDS ASKED

Mo., Kansas City—GRAIN ELEVATOR—Feb. 24, by Missouri Pacific Ry. Co., E. A. Hadley, ch. engr., Missouri Pacific Bldg., St. Louis, and Continental Export Co., Merchants Exch. Bldg., St. Louis, superstructure 2,500,000 bu. grain elevator, rein.-con., Topping and Gardiner Aves., $1,000,000. E. Ahlskog, 407 South Dearborn St., Chicago, Ill., consult. engr. Noted Feb. 5.

Que., Montreal—GRAIN ELEVATOR—Canada Malting Co. Ltd., 5022 St. Ambroise St., taking bids 600,000 bu., rein.-con. foot of St. Ambroise St. John S. Metcalf Co., C. E., 460 Helen St., archts.

POWER AND LIGHTING

PROPOSED WORK

Calif., Glendale—City appropriated $25,000, overhead lighting system in connection with light department; $35,000, purchasing substation equipment for San Fernando and Grand View Stations; $17,000, poles and fixtures; $15,000, line transformers and devices; $8,000, underground conduits; $8,000, meters.

Ind., Richmond—See "Power Plants."

Texas—West Texas Utilities Co., Abilene, extending 40 mi. power line from Sterling City to serve rural customers, also 22,000 volt line to run to Robert Lee to serve waterworks system there. Private plans.

Tex., Galveston — Galveston Baseball Club, c/o S. Moody, flood light system at baseball park. $30,000-$35,000. Private plans.

Virginia—See "Power Plants."

Wash., Seattle—Bd. P. Wks. soon takes bids fabricating, erecting transmission towers for Diablo-Seattle transmission line. $500,000.

BIDS ASKED

Ill., Chicago—Feb. 24, by M. J. Kennedy, comr. Gas & Electricity, City Hall, Div. A, control equipment for progressive movement of traffic, Div. B, two-way traffic signal controllers, Div. C, electric traffic signals; also fire alarm combination printing regulators, combination, polarized and signal line relays.

Tex., Wichita Falls—Wichita Falls Baseball Club, c/o President, Wichita Falls, taking bids and open same about Feb. 20, flood light system for Texas League Baseball Park. $30,000. Private plans.

CONTRACTS AWARDED

Tex., Yoakum—City, c/o E. S. Winfrey, mayor, light and power system, incl. complete distribution system, power plant building, cooling tower, fuel oil tanks, power and auxiliary equipment, to Fairbanks-Morse Co., 1713 North Market St., Dallas, $225,000. Noted Jan. 29.

Wash., Seattle—Bd. P. Wks., 736 mi. circular mill aluminum conductor steel, reinforced mallard type transmission line for Diablo-Seattle Project, to Aluminum Co. of America, Railto Bldg., San Francisco, Calif., $737,155. Noted Feb. 11 Daily.

PARKS AND SPORTS

PROPOSED WORK

Ia., Boone—City, c/o O. Hile, clk., bids in March, 60 x 140 ft. swimming pool, 40 x 40 ft. wading pool, sand beach, also brick, concrete bath house. $25,000. G. P. Nelson, city engr. C. A. Hyatt, 5555 Sheridan Rd., Chicago, Ill., archt.

Mass., Cambridge—City, R. Russell, mayor, City Hall, 1 story, concrete recreation and locker building at Fresh Pond Playground. $25,000. Engineer not selected.

Mass., Yarmouth—Town, Bd. Selectmen, C. R. Bassett, public playground, incl. ball fields, etc. $25,000.

N. J., Mays Landing — Bd. Town Council, Town Hall, improving memorial park by grading, sodding, landscape work, concrete walks, drinking fountain, monument. $50,000.

N. Y., Massapequa—C. W. Beall, c/o Long Island Zoological Park, bids late in April, general contract amusement park, zoo, hippodrome. $150,000. Noted Feb. 12.

O., Cleveland — City, D. E. Morgan, mgr., plans by H. Kregelius, 504 City Hall, 2 swimming pools, concrete, steel, terra cotta, East 46th St. and Central Ave. $300,000.

Tex., Beaumont — South Texas Fair Assn. (Municipal), improving fair grounds and physical assets, incl. new building, tracks. $100,000 bond election soon for same. Address R. C. Black, city engr.

Ont., Toronto—Maple Leaf Hockey Club, 13 King St. W., plans by Ross & McDonald, 601 Belmont St., Montreal, Que., 1 and 2 story, concrete, brick, steel, stone hockey and sports arena. $1,250,000. Noted Jan. 29.

BIDS ASKED

Calif., Sacramento—Mar. 3, by G. B. McDougall, state archt., Public Works Bldg., 1 story, 63,000 sq.ft., rein.-con., brick live stock exhibit building, plain concrete found., for State Agricultural Park. $150,000.

Ind., Indianpaolis—Feb. 24, by Bd. School Comrs., A. B. Good, bus. dir., portable steel bleachers for auditorium-gymnasium at Arsenal Technical Schools, 1500 East Michigan St.

Me., Kents Hill—Maine Wesleyan Seminary & Women's College, T. W. Watkins, taking bids 1 story, 70 x 120 ft. and 25 x 100 ft., brick, concrete gymnasium, locker, college grounds. $70,000. Bunker & Savage, 256 Water St., Augusta, archts. Noted Feb. 5.

Mass., Boston—Feb. 20, by City, Park Dpt., 33 Beacon St., 1 and 3 story, 30 x 350 ft., brick, concrete bathhouse, locker and laundry, plain found., North End Park. $125,000. Former bids rejected. O'Connell & Shaw, 134 Newbury St., archts. Noted Jan. 22.

CONTRACTS AWARDED

Mo., Trenton—City, 116 x 200 ft. concrete swimming pool, 750,000 gal. capacity, also brick, concrete bath house, gravity flow filtration plant, to Ebbe Constr. Co., Trenton, $25,750. Noted Oct. 23.

Okla., Stillwater—Oklahoma Agricultural & Mechanical College, 25,000 seating capacity concrete, steel stadium, 8,500 seating capacity, rein.-con., brick, steel field house, on campus, to Lyons & Co., 317 North Harvey St., Oklahoma City. Est. $600,000. Noted Jan. 22.

Tex., Galveston — Galveston Baseball Club, c/o S. Moody, Texas League Baseball Stand, 60 x 500 ft., steel, concrete, timber 7,500 seating capacity, to F. G. Butler, 3619 Q½ St., $70,000. Noted Feb. 5.

Que., Montreal—City, public bath, Florian St., to Concrete Constr. Co., 58 Decarie Bldg., $86,220.

HEATING AND VENTILATING

BIDS ASKED

Ind., Bloomington — Feb. 27, at office J. W. Cravens, secy. Bd. Trustees Indiana University, heating, ventilating, plumbing, electric wiring, elevators, for union building, on campus. Granger & Bollenbacher, 333 North Michigan Ave., Chicago, Ill., archts.

N. Y., New York—Mar. 6, by Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., ventilation equipment for line A from Fulton to 207th Sts. of Independent Subway System of City-Owned Rapid Transit Railroads.

UNCLASSIFIED

PROPOSED WORK

Conn., New Haven — LABORATORY — Connecticut Agricultural Experimental Station, Huntington, New Haven, Jenkins Laboratory for agricultural experiments, brick. $50,000. Architect not selected.

Unclassified (Continued)

Ill., Ottawa—TERMINAL—City, c/o Special Waterway Comn., W. I. Nibbs, chn., sketches river rail terminal for proposed Illinois River Barge Line. $100,000. Engineer and architect not selected.

Florida—TELEPHONE EXTENSIONS—Inter-County Telephone & Telegraph Co., Fort Meyers, made application to United States War Dpt., for permit to carry out 3 extension projects as follows: erecting overhead telephone and telegraph line at least 35 ft. above mean low water at draw span of county drawbridge, Matlacha Pass; placing armored submarine cable at least 2 ft. below bottom of Peace River at 500 ft. opening to be left in old county bridge when new state road is completed at Punta Gorda; placing armored marine cable 2 ft. below bottom of river at drawspan of new state road bridge, Fort Meyers.

Mass., Walpole—MEMORIAL—Town, H. L. Caldwell, chn. com., sketches by Putnam & Cox, 114 State St., Boston, memorial, Kendall St. $50,000. Noted July 3.

N. J., Hackensack—INDUSTRIAL CENTER—New Jersey Meadows Reclamation Comn., J. W. Binder, 210 Main St., industrial center, incl. factories, residential and recreation districts. $150,000 or more. Architect not selected.

N. J., Peapack — STABLES — R. V. N. Gambill, c/o J. C. McKenzie, Jr., 3 East 57th St., New York, soon lets contract 1 and 2 story, basement, 150 x 150 ft., brick, steel, stable group, plain and shoring founds. $150,000. Bids in.

O., Toledo — ASPHALT PLANT — Standard Oil Co. of Ohio, 526 High St., asphalt plant. $1,000,000.

Ore., Baker — GAS PIPE LINE — Mountain States Oil & Gas Co., Weisner, Idaho, applied for gas franchise for the city of Baker. If granted will necessitate construction gas pipe line from gas mills seven miles from Weiser, Idaho, to here. $1,000,000. H. L. Melton, Baker, engr.

Tenn., Memphis — TERMINAL — National Tube Co., subsidiary United Steel Co., 71 Bway., New York, soon lets contract steel river-rail terminal, on 10 acre site, West Calhoun and West Georgia Aves. To exceed $1,000,000.

BIDS ASKED

Mo., St. Louis—STONE RAILINGS—Mar. 10, by Bd. P. Serv., stone railings on Grand Dr. Bridge and bridge on Lindell and Union Blvd. in and adjacent to Forest Park. $25,000. L. R. Bowen, city engr.

N. Y., Long Island City—PUMPING EQUIPMENT—Feb. 20, by Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., New York, furnishing, installing pumping equipment on Routes 106 and 108, Agreement "KG."

N. Y., New York—DOCK—Mar. 11, at office Dpt. Mental Hygiene, State Office Bldg., Albany, repairing west dock, Manhattan State Hospital, Ward's Island. $37,908. F. W. Parsons, comr.; adv. E. N.-R. Feb. 19.

N. Y., New York—PUMPING EQUIPMENT—Feb. 20, by Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., furnishing, installing pumping equipment on Routes 106 and 108, Bronx and Queens Boros. Former bids rejected. Noted Jan. 15.

N. Y., New York—RECTIFIER STATIONS—Feb. 27, by Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., underground rectifier stations on Route 78, Sect. 4-A and Route 106, Sects. 1 and 2, Group 3.

N. Y., New York — TREATED and UNTREATED TIES — Feb. 24, by Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., supply treated and untreated ties and contact rail protection boards (Order 14) and special work (rails, frogs and switches) and contact rail for Rapid Transit Railroads.

O., Cleveland—ELECTRICAL WORK—Mar. 9, by Bd. Educ., electrical work in South High School. $85,000. G. M. Hopkinson, Auditorium Garage Bldg., archt.

CONTRACTS AWARDED

California — GASOLINE PIPELINE — Associated Oil Co., P. E. Bldg., Los Angeles, subsidiary Tidewater Associated Oil Co., 17 Battery Pl., New York, pipe for 60 mi. gasoline pipe line from Belridge oil fields to Coalinga, connecting with existing line at Monterey, to Youngstown Sheet & Tube Co., Stambaugh Bldg., Youngstown, O. Est. $750,000.

Conn., Hartford—CEMENT-MIXING PLANT—Edward Balf Co., 14 Haynes St., brick cement-mixing plant, Haynes St. To exceed $40,000 with equipment. Owner builds.

Ill., Chicago—DREDGE PUMP, etc.—Latham D. Smith Dock Co., 4328 Irving Park, 31,000 g.p.m. dredge pump, turbines, other equipment, to Westinghouse Electric & Mfg. Co., 150 Bway., New York. Est. exceeds $45,000.

La., New Orleans—SPRINKLER SYSTEM—Bd. Comrs. Port of New Orleans, New Orleans Court Bldg., J. McKay, genl. mgr., installing automatic sprinkler system, to Grinnell Co., Inc., New Orleans Bank Bldg., New Orleans, La., and Providence, R. I., $1,134,000. Noted Jan. 8, under "Contracts Awarded."

N. Y., New York—DREDGE PUMPS—O'Brien Bros. Sand & Gravel Corp., 233 Bway., 2 dredge pumps, driving turbines, to Westinghouse Electric & Mfg. Co., 150 Bway. Est. exceeds $40,000.

Oklahoma, Kansas, Missouri, Iowa, Texas and Illinois—GAS PIPE LINE—Great Lakes Pipe Line Co., Ponca City, Okla., 1,000 mi. 10- to 16-in. c.i. welded natural gas pipe line from Borger, Tex., through Oklahoma, Kansas, Missouri, Iowa and Illinois, to Oklahoma Contg. Co., Oklahoma City, Okla., and Allen Bldg., Dallas, Tex., $3,600,000; pipe, to National Tube Co., 71 Bway., New York. Est. $11,000,000. Noted July 31.

MATERIALS

PROPOSED WORK

WATER PIPE—Chicago, Ill.—City, City Hall, soon takes new bids 16,365 tons 30, 36 and 48 in. c.i. water pipe. Former bids rejected. R. W. Wolfe, comr. P. Wks.

BIDS ASKED

COPPER WIRE—San Francisco, Calif.—Feb. 24, by L. S. Leavy, city purch. agt., furnishing, delivering 4 mi. 3/0 round copper trolley wire, for Bd. P. Wks.

LUMBER—El Nido, Calif.—Feb. 25, by A. L. Cowell, secy. El Nido Irrigation Dist., 122,000 bd. ft. redwood lumber, 98,000 bd. ft. Oregon pine lumber.

WATER PIPE—Gridley, Calif.—City Trustees taking bids 1 carload water pipe for municipal waterworks extensions.

CINDERS—Chicago, Ill.—Feb. 20, by City, City Hall, 36,000 cu.yd. cinders on runways at municipal airport, between 59th and 63rd Sts. and Cicero and Central Aves. R. W. Wolfe, comr. P. Wks.

CULVERT PIPE, LUMBER, etc.—Ida Grove, Ia.—Feb. 24, at office Auditor Ida Co., 2,400 lin.ft. culvert pipe, steel requirements for 5-V-4B I-beam bridge, 4 cars for lumber, 1 car creosoted lumber, 2 cars creosoted piling and posts.

STEEL, TRAFFIC TREADS, etc.—Knoxville, Ia.—Mar. 4, at office Auditor Marion Co., culvert pipe, nails, paint, structural steel, traffic treads.

CAST IRON PIPE—Baltimore, Md.—Feb. 25, by Bd. Awards, c.i. pipe and fittings to Bureau Water Supply, E. G. Rost, Municipal Bldg., water engr.

MANHOLE FRAMES, etc.—Baltimore, Md.—Feb. 25, by Bd. Awards, furnishing, delivering manhole and hand box covers and frames, incl. 133,700 lb. manhole castings and covers to Bureau of Mechanical-Electrical Service. W. Viessman, Municipal Bldg., mechanical-electrical engr.

ROAD OIL—Minneapolis, Minn.—Feb. 24, by F. S. Gram, purch. agt., 3,000,000 gal. road oil. N. W. Elsberg, city engr.

WATER METERS—Minneapolis, Minn.—Feb. 24, by F. S. Gram, city purch. agt., 4,500 water meters. N. W. Elsberg, city engr.

STEEL, LUMBER, TILE, etc.—Jackson, Miss.—Feb. 28, by State Hospital Removal, Impvt. & Land Sale Comn., House of Representatives, New Capitol Bldg., washed gravel and sand, portland cement, waterproofing reinforcing steel, drain tile, form lumber, for Hospital for Insane, Rankin Co., near here. N. W. Overstreet, Standard Life Bldg., archt.

STEAM ASHES—Long Island City, N. Y.—Feb. 24, by G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., 5,000 cu.yd. steam ashes in 5th Ward.

ASPHALTIC CEMENT, etc. — New York, N. Y. — Feb. 25, by S. Levy, pres. Manhattan Boro, Municipal Bldg., 600,000 gal. asphaltic cement, 5,100 pcs. spruce lumber, 50,000 special 5 in. granite paving blocks, 40,000 gallons furnace oil.

PIPE—New York, N. Y.—Feb. 24, by P. J. Dooling, comr. Purchase, Municipal Bldg., c.i. pipe, special, valve box castings, valves, hydrant, drain bases, D. M. hydrants, check valves, rodding bands, W. I. rods, nuts and washers, for Dpt. Water Supply, Gas & Electricity, Bronx Boro.

CEMENT, etc.—Cleveland, O.—Feb. 20, by City, 10,000 bbl. portland cement, 4,000 tons paving sand, 8,000 tons binder stone, 800 tons asphalt dust, 3,000 cu.yd. mixed concrete, 10,000 tons asphalt sand.

REINFORCING BARS—Oklahoma—State Hy. Dpt., Oklahoma City, in market 5,000 tons mild steel reinforcing bars for use in hy. construction. A. R. Losh, hy. engr.

LUMBER—Milwaukee, Wis.—Feb. 24, by Central Bd. Purchases, 26,000 ft. Douglas fir, 24,400 ft. creosoted yellow pine, 62,000 ft. untreated yellow pine, 23,362 ft. Douglas fir untreated, 50,020 ft. untreated oak. J. W. Nicholson, purch. agt.

CAST IRON PIPE—Vancouver, B. C.—Mar. 9, by City Council, 20,000 ft. c.i. or steel water pipe. C. Brackenridge, City Hall, engr.

CONTRACTS AWARDED

PIPE, etc. — Madera, Calif. — J. Wakefield, city clk., 3,500 ft. 6 in. c.i. pipe with fittings, to Pacific States Cast Iron Pipe Co., 111 Sutter St., San Francisco, $2,386. Noted Jan. 22 under "Waterworks."

CULVERT PIPE—Elkader, Ia.—. E. Firman, aud. Clayton Co., 5,700 ft. 15 in., 6,120 ft. 18 in., 2,850 ft. 24 in., 600 ft. 30 in., 1,800 ft. 36 in. culvert pipe, to Iowa Culvert & Pipe Co., Mason City, $15,326.

GRAVEL—St. Paul, Minn.—G. J. Riess, aud. Ramsey Co., 10,000 tons gravel and 2,000 tons sand, to J. L. Shiely Co., 209 Builders Exchange, St. Paul, at $0.50 per ton each. Noted Jan. 22.

PAVING BLOCKS—New York, N. Y.—P. J. Dooling, comr. Purchase, Municipal Bldg., granite paving blocks, to Walthaw Corp., 1860 Bway., $25,227; wood paving blocks, to Jennison-Wright Co., 30 Church St., $7,305. This corrects report in Feb. 5 issue.

PORTLAND CEMENT—Oklahoma—State Hy. Dpt., Oklahoma City, 50,000 bbl. portland cement for highway use, to Monarch Cement Co., Humboldt, Kan., at $1.40 per bbl., f.o.b. factory; 950,600 bbl. to Oklahoma Portland Cement Co., Perrine Bldg., Oklahoma City, at $2.08 per bbl. f.o.b. various cities in state. Total est. $2,000,000.

SPECIAL CASTINGS, etc.—Milwaukee, Wis.—Central Bd. Purchases, 350 tons special castings and 90 tons offset pipe, to L. G. Zimmermann, c/o Municipal Foundry's, West Allis, at $67 and $80 per ton respectively; 7 tons topping sleeves, to Filer & Stowell Co., 309 West Becher St., at $94 per ton. Noted Jan. 9 Daily.

EQUIPMENT

PROPOSED WORK

DIESEL ENGINE — Gridley, Calif. — J. L. Lewis, city clk., rejected bids Jan. 12, Diesel engine. Noted Dec. 8.

BIDS ASKED

TRUCK—Chula Vista, Calif.—Feb. 24, by C. S. Timmons, city clk., 3-ton dump truck.

MOTOR TRUCK—Los Gatos, Calif.—Mar. 2, by D. M. Winning, city clk., 1½ ton motor truck for Street Dpt.

TRACTOR and MAINTAINER — Vincennes, Ind.—Mar. 3, by Bd. Comrs. Knox Co., at office H. C. Sloan, aud., Court House, tractor and road maintainer.

MOTOR GENERATOR SET — New Orleans, La. — Feb. 24, at office Dpt. Pub. Finances, Purchasing Div., City Hall, motor generator set. A. M. Pratt, comr.

POST HYDRANTS—Boston, Mass.—Feb. 20, by Dpt. P. Wks., 50 post hydrants. $5,000. J. A. Rourke, comr.

WATER METERS—Anchorville, Mich.—Feb. 21, by D. W. Beauvais, clk. Ira Twp., 500 standard quality ¾ in. frost proof water meters, delivered at Fair Haven.

TRACTOR, etc.—Gaylord, Minn.—Mar. 18, by F. Hoppenstedt, aud. Sibley Co., 1 tractor and 2 patrol graders.

TRACTOR—Freehold, N. J.—Feb. 28, by Twp. Com., Library Bldg., 1 man motor patrol tractor scraper outfit, either crawler or rubber tired wheels. $5,000. A. D. Bullock, 128 West State St., Trenton, twp. engr.

AUTOMOTIVE EQUIPMENT — New York, N. Y.—Feb. 20, by P. J. Dooling, comr. Purchase, Municipal Bldg., automotive equipment to Dpts. Parks, Bronx and Brooklyn.

SERVICE CARS—New York, N. Y.—Feb. 20, by Bd. Transportation, J. D. Delaney, chn., 250 Hudson St., furnishing, delivering service cars for Independent System of City-owned Rapid Transit Railroads.

TANDEM STEAM ROLLERS, etc. — New York, N. Y. — Feb. 25, by S. Levy, pres. Manhattan Boro, Municipal Bldg., one 12 ton and one 8 ton tandem steam roller; three 2-2½ ton chassis.

OIL CIRCUIT BREAKERS, etc. — Cleveland, O.—Feb. 20, by City, oil circuit breakers, control panels, instrument transformers for municipal lighting plant.

ROCK CRUSHING MACHINERY—Connellsville, Pa.—Youghiogheny Crushed Stone Co., in market rock crushing machinery, for $175,000

GRADER, etc.—Austin, Tex.—Mar. 7, by Travis Co., c/o J. A. Belger, aud., 1 grader and one 10 ton tractor. J. G. Morgan, Austin, co. engr.

DUMP TRUCKS—Ellsworth, Wis.—Feb. 24, by Pierce Co. Hy. Comn., two 1½ yd. dump truck with hydraulic hoists; 1 push type, motor patrol; 1 rubber tired tractor to haul; pull type grader; one 1½ cu.yd. bucket power shovel; 1 single-unit crusher.

FOREIGN

Australia, Melbourne — Apr. 7, by Post & Telegraph Dpt., supply of testing instruments, incl. cell testing, voltmeters, detectors, hydrometers and battery testing thermometers.

Australia, Melbourne—Mar. 31, by Port & Telegraph Dpt., lead covered cables, 4 pr.—10 pr.—15 pr. and 25 pr. telegraph switchboard cable and for single and double wound resistance spools to sealed patterns.

Australia, Melbourne—Mar. 17, by Post & Telegraph Dpt. 80 miles rubber insulated cotton covered twisted conductors.

New Zealand, Wellington — Mar. 17, by P. Wks. Dpt., 11,000 volt switchgear and metering equipment for controlling 15,000 kva. substation.

New Zealand, Wellington—Apr. 9, by Government Railway Dpt., transformers, armoured cables, involving switches, static condensers.

New Zealand, Wellington—May 5, by P. Wks. Dpt., 66,000 volt and 33,000 volt outdoor switchgear for Lake Coleridge.

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Commercial Buildings

RESIDENTIAL

BIDS ASKED

Conn., South Norwalk—E. Hoyt, 10 Robinson Ave., Danbury, taking bids 3 story, basement, 65 x 82 ft., brick, cast stone, concrete apartment, store, plain found., Webster St. $125,000-$150,000. W. J. Koellmer, Merrill Rd., Norwalk, archt.

La., Baton Rouge — Interstate Hotel Co., Baton Rouge, and Shreveport, c/o A. Glassell, soon lets contract 7 story, rein.-con., brick, steel, stone. $200,000. E. F. Neild, Shreveport, Archt. Noted Feb. 12.

N. Y., Brooklyn—See "Contracts Awarded."

N. Y., New York—See "Contracts Awarded."

N. C., Charlotte—Mecklenburg County Land Corp., c/o K. Murchison, pres., 101 Park Ave., New York, will award contract about May 1 on bids already taken or will then take new bids for hotel, theatre. Noted Dec. 18.

Wash., Seattle — A. Geiser, archt., Lloyd Bldg., bids about Feb. 25, 4 story, basement, 90 x 118 ft., brick, terra cotta, 404 Boylston Ave., for E. Pohl, Railway Exch. Bldg., $150,000.

Ont., Toronto—See "Contracts Awarded."

CONTRACTS AWARDED

Calif., Calexico — W. Conway, frame, stucco hotel, coffee shop, offices, stores, patio, to Austin Co. of California, 777 East Washington St., Los Angeles, $150,000.

Neb., Holdredge—L. Luke, 412 West 5th St., Ottawa, Kan., general contract 6 story, basement, 50 x 100 ft., rein.-con., brick hotel, to E. J. Straub Contg. Co., 417 Gloyd Bldg., Kansas City, Mo. Est. $150,000.

N. Y., Brooklyn—Berles Realty Co., 1935 66th St., 6 story, Ada Court, separate contracts. $175,000. Cohn Bros., 215 Montague St., archts.

N. Y., Brooklyn—Corporation, c/o A. Fishkind, 1355 Ocean Parkway, 6 story, Avenue O and Ocean Parkway, separate contracts, $225,-000. S. L. Malkind, 93 Court St., archt.

N. Y., Brooklyn — Raison Realty Corp., L. Raichelson, pres., 749 Van Smideren Ave., 6 story, 63rd St. and 24th Ave., separate contracts. $200,000. M. Hirsch, 350 Stone Ave., archt.

N. Y., Brooklyn — Twin City Development Corp., 1334 48th St., 6 story, 52nd St. and 15th Ave., separate contracts. $185,000. S. Gardstein, 44 Court St., archt.

N. Y., Brooklyn — Wilmar Constr. Corp., S. Kishner, secy., 227 Brier Court, 6 story, Humbert St. and Ocean View Ave., separate contracts. $150,000. Seelig & Finkelstein, 153 Pierrepont St., archts.

N. Y., Brooklyn—B. Zurick, 301 East 8th St., apartment, Lenox Rd. and Rogers Ave., separate contracts. $225,000. Seelig & Finkelstein, 153 Pierrepont Ave., archts.

N. Y., New York—C. Cianipi Realty Co., 501 East Tremont Ave., 6 story, 96 x 100 ft., Holland and Astor Aves., separate contracts, $150,-000. C. J. Clark, 441 East Tremont Ave., archt.

N. Y., New York—Corporation, c/o J. Aisenberg, 1460 Westchester Ave., 6 story, Boynton Ave. and Eastern Blvd., separate contracts. $400,000. L. R. Uffner, 202 West 40th St., archt.

N. Y., New York—Dabelle Realty Corp., 1070 Anderson Ave., 6 story, 86 x 106 ft., Anderson Ave. and 165th St., separate contracts. $175,000. C. Kreymborg, 2534 Marion Ave., archt.

N. Y., New York — C. E. Deverman, 101 Pennyfield Rd., apartment, Olmstead and Haviland Aves., separate contracts. $150,000. I. L. Crausman, 332 East 149th St., archt.

N. Y., New York—Evander Realty Co., S. Glass, pres., 986 Forest Ave., 6 story, Devoe Ave. and 177th St., separate contracts. $250,-000. Springsteen & Goldhammer, 40 East 49th St., archts.

N. Y., New York—Freidce Realty Corp., 1334 Harrison Ave., 6 story, 639 West 204th St., separate contracts. $150,000. G. Swiller, 4215 3rd Ave., archt.

N. Y., New York—H. W. C. Building Co., H. I. Seruke, pres., 211 East 188th St., 6 story, 83x100 ft., Briggs and Bedford Park Aves., separate contracts. $150,000. A. Schaefer, 2408 Grand Concourse, archt.

N. Y., New York — M. Schachnow, 285 Madison Ave., 6 story, Heath Ave. and Shirdy Pl., separate contracts. $250,000. I. L. Crausman, 332 East 149th St., archt.

N. Y., New York—Two Beekman Place Corp., 5 Skillman Pl., Bridge Plaza, Long Island City, 17 story apartment, 15 Mitchel Pl., to Lane Ogle, Inc., Pier 3, North River. Est. $1,250,-000. Noted Jan. 29.

Ont., Toronto—Kensington Apartments Ltd., c/o V. L. Morgan & Co., archts., 1454A Yonge St., 4 story, basement, brick, concrete, steel, stone, day labor; excavation, to J. McKay, 26 Thelma Ave.; concrete, to V. Pompilio, 48 Grace St.; masonry, to J. Bruno, 124 Millicent Ave. $150,000.

CLUBS

PROPOSED WORK

N. J., Newark — D. R. Rizzolo, archt., 625 North 6th St., soon lets general contract altering and constructing 4 story, basement, brick, steel, addition to temple and stores, 42-44

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Hill St., for I.O.O.F. Three Link Temple, Inc., 42 Hill St. $150,000. Noted Feb. 12.

Que., Lachine — A. F. and A. M. Victoria Lodge, S. M. Taylor, secy., 377 St. Antoine St., masonic temple. $200,000. Architect not selected. **Maturity in April.**

BIDS ASKED

Ill., Chicago—Northern Athletic Club, 2310 Lawrence Ave., taking bids 13 story, rein.-con., brick, Oakley and Lawrence Aves. W. G. Uffendell, 39 South State St., archt. Noted Dec. 25.

CONTRACTS AWARDED

Neb., Lincoln—Nebraska Bd. Agriculture, G. Jackson, secy., general contract 4-H Club, 2 story, basement, 120 x 320 ft., rein.-con., brick, steel, stone, Nebraska State Fair Grounds, to E. Rokahr & Sons, 756 Stuart Bldg., $94,903.

R. I., Warwick — Warwick Country Club, E. R. Bancroft, reconstructing 3 story, basement, brick, plain found., at Warwick Neck, to C. T. Algren, East Greenwich. Est. $150,000.

HOSPITALS

PROPOSED WORK

Calif., Yountville—State of California, Sacramento, plans by F. H. Meyer, 525 Market St., San Francisco, fireproof veterans hospital. $500,000.

Conn., Hartford—State, Cedarcrest Sanatorium, infirmary and nurses home at sanatorium. $225,000 appropriation granted. Architect not selected.

Conn., Norwich — State, Uncas-on-Thames Sanatorium, nurses home $120,000, infirmaries $320,000, cottages, service, etc. $110,000. Architect not selected.

Conn., Shelton—State, Laurel Heights Sanatorium, nurses' home and doctor's cottage. $160,000. Architect not selected.

Mass., Lakeville (mail Middleboro)—Commonwealth of Massachusetts, Dpt. P. Health, Boston, sketches by Stevens & Lee, 45 Newbury St., Boston, brick infirmary, Main St. $150,000.

Neb., Lincoln—Mount Moriah Holding Corp., c/o E. G. Stage, 1905 Y St., sketches by Meginnis & Schaumberg, 614 Federal Trust Bldg., 5 story, 42 x 132 ft., brick, concrete nurses' home, 3 story, 40 x 100 ft., brick laundry and heating plant, 50th and Lillibridge Sts. $260,000.

N. J., Holmdel—Dpt. Institutions & Agencies, State Office Bldg., Trenton, revised plans by Div. Architecture & Constr., State Office Bldg., Trenton, 3 story, basement, brick, steel reception treatment hospital, New Jersey State Hospital. $1,000,000. Noted Nov. 13.

N. J., Jersey City—Jewish Hospital Assn., B. S. Pollick, chn., Laurel Hill, Secaucus, 4 story basement, brick, steel, Fowler and Van Nostrand Aves. $1,000,000. Architect not selected.

O., Cleveland—City, D. E. Morgan, city mgr., plans by H. Kregelius, 504 City Hall, 3 story, basement, 40 x 250 ft., brick, steel, concrete addition to tuberculosis sanitarium, Warrensville Farm, $250,000; 6 story, basement, 130 x

R. I., Burrillville (mail Harrisville)—State Sanitarium. H. L. Barnes, supt., altering and constructing nurses home, refrigeration, plant, laundry, kitchen building additions. To exceed $150,000. Architect not selected.

BIDS ASKED

Ark., Little Rock — Pulaski Co. Hospital Assn., Inc., J. V. Stewart, secy., Boyle Bldg., delayed construction four 1 and 3 story, brick, concrete and stone hospital buildings. $600,000. Approved bond issue declared illegal. Wittenberg & Deloney, Home Insurance Bldg., archts. Noted Jan. 22.

Ind., Ft. Wayne—Bd. Comrs. Allen Co., bids about Apr. 1, brick, steel sanitarium on Lima Rd., 8 mi. north of here. $150,000. L. Bowers, 4215 Fairfield St., archt.

Ind., Indianapolis — Mar. 4, by Bd. Comrs. Central Insane Hospital, 3000 West Washington St., 3 rein.-con., brick buildings, $150,000. Bevington-Williams, McGuire & Shook, K. of P. Bldg., archts. Noted Jan. 8.

Mo., St. Louis—Mar. 17, by Bd. P. Serv., City Hall, 6 story, basement, 99 x 244 ft., rein.-con., brick, steel, nurses' home, Grattan and Carroll Sts. $556,000. A. Osburg, city archt. L. R. Bowen, city engr. Noted Nov. 13.

N. H., Littleton—Littleton Hospital, H. M. Eaton, pres. Bd. Trustees, takes bids about Mar. 1, general contract 3 story, basement, brick, steel hospital addition, power house. $150,000. Rich, Mathesius & Koyl, 320 5th Ave., New York, archts.

N. Y., New York—Feb. 27, by Dpt. Hospitals, J. G. W. Greef, comr., Municipal Bldg., nurses home addition, at Riverside Hospital, North Brother Island. G. M. McCabe, 96 5th Ave., archt.

Pa., Phila.—Feb. 25, by Zantzinger, Borie & Medary, archts., Architects Bldg., 7 story, basement, 44 x 47 ft. and 56 x 111 ft., rein.-con., brick, steel hospital, plain found., for Womens Hospital, Preston and Parrish Sts., G. H. Earl, pres. building comn.

Tex., Galveston—John Sealy & Smith Foundation, E. Randall, chn. Building Com., bids about Mar. 1, 4 story, basement, E-shaped, 88 x 200 ft., brick, rein.-con. nurses' home, concrete pile found., $400,000. R. L. White, c/o John Sealy Hospital, Galveston, and c/o State University, Austin, engr. and archt. Noted Jan. 1.

Tex., Galveston—Feb. 28, by University of Texas, Bd. Regents, c/o J. W. Calhoun, comptroller, Austin, 4 story, brick, stone, rein.-con. laboratory. $350,000. H. M. Greene, La Roche & Dahl, 307 Constr. Bldg., Dallas, archts. Gardner & Howe, Kirby Bldg., Dallas, structural engrs. Noted Dec. 25.

CONTRACTS AWARDED

Ark., Benton — State Hospital for Nervous Diseases, c/o State Constr. Comn., J. M. Hill, chn., Ft. Smith, general contract (1st unit) hospital group, incl. 4 patients dormitories, assembly building, cafeteria and kitchen, to W. Peterson, Donaghey Bldg., Little Rock, $327,-500. Noted Nov. 27.

Ill., Chicago — Sisters of Holy Family of Nazareth, 1120 North Leavitt St., masonry and carpentry contract 6 story, 35 x 130 ft. brick hospital, 1100-24 North Leavitt St., to Local Constr. Co., 4337 Melrose St. $350,000.

Mass., Gloucester — Addison Hospital, c/o Phillips & Holloran, archts., 191½ Main St., 2 and 3 story, basement, brick nurses' home and ward building, plain found., to R. E. Runnels Constr. Co., 24 Merrimac St., Lowell. Est. $150,000. Noted Feb. 5.

CHURCHES

PROPOSED WORK

Conn., West Hartford (br. Hartford)—Asylum Ave. Baptist parish, Asylum and Sigourney Sts., Hartford, F. B. Haggard, pastor, 31 West Linwood Dr., rebuilding church, recently destroyed by fire. $150,000 or more. Architect not selected.

Ind., Muncie—Brethren Church plans by A. A. Honeywell, 123 East 44th St., 66 x 106 ft., brick, steel, stone church, Sunday school. $150,000.

N. J., Athenia—St. Joseph's Roman Catholic Church, L. Szor, pastor, 5 Parker Ave., Passaic, 2 story, basement, brick, steel church, school, Spier Ave. $150,000. M. L. Waeber, 131 East 47th St., New York, archt. Project in abeyance. Noted Nov. 13.

N. J., Garfield—First Presbyterian Church, R. W. Key, pastor, 132 Palisade Ave., 1 story, basement, brick, steel Sunday school, Palisade Ave. $150,000. **Maturity in May.** J. H. Dynes, 7 Palisade Ave., archt. Noted Jan. 29.

N. J., Newark—R. Nordin, archt., 207 Market St., Newark, bids probably about Apr. 1, general contract revised plans altering and constructing 2 story, basement, brick, steel Sunday school addition, Roseville and Sussex Aves., for Roseville Presbyterian Church, Roseville Ave. $150,000. Noted Jan. 22.

N. J., Rutherford—Bd. Trustees Presbyterian Church, East Passaic Ave., will not build brick, steel parish house, Ridge Rd. $150,000. Architect not selected. Noted Jan. 15.

N. J., Westfield—A. R. Hennell, archt., 636 Prospect St., soon lets general contract 3 story, basement, brick, steel parish house addition, St. Paul Ave. for St. Paul's Episcopal Church, $150,000.

R. I., Pawtucket—Park Place Congregational Church, R. O. Harpole, pastor, 122 Greene St. $150,000. Architect not selected.

R. I., North Providence (mail Providence)—Church of Holy City (Episcopal), G. E. Manson, pastor, 478 Fruit Hill Ave., 1 and 3 story, basement, brick, stone church, parish house. $175,000. Architect not selected.

Que., L'Ange Gardien—L'Ange Gardien Roman Catholic Parish church. $350,000.

Que., Montreal—Father St. Jean of St. Denis Parish sketches new church. $350,000.

BIDS ASKED

N. J., East Orange—A. Humble, archt., 6 East 45th St., New York, taking bids general contract altering and constructing 2 story, basement, brick, steel addition, plain and shoring found., Prospect and Norman Sts., for Central Church of Bloomfield and East Orange. $150,000.

N. J., Glen Ridge—Guilbert & Betelle, archts., 20 Branford Pl., Newark, bids about Apr. 15, general contract 2 story, basement, brick, steel church and Sunday school, for Glen Ridge Congregational Church, Ridgewood Ave. $200,-000. Noted Feb. 5.

CONTRACTS AWARDED

N. J., Caldwell—N. Hule, archt., 1524 Chestnut St., Phila., Pa., general contract 3 story, basement, brick, steel, Sunday school and fellowship hall, to J. B. Roberts Co., 949 Bway., New York, for First Methodist Church, A. E. Armstrong, pastor, 7 Washburn Pl. $150,000. Contractor soon takes separate contract bids. Noted Feb. 5.

N. Y., New York—Park Avenue Community Church, 3-11 Park Ave., 7 story church, 26 story hotel, to Geekie-Naughton, Inc., 420 Lexington Ave. Est. $3,450,000. Noted Jan. 8.

SCHOOLS

PROPOSED WORK

Calif., Arcata — State of California, Sacramento, plans by F. T. Georgeson, 6th and G Sts., Eureka, fireproof training school. $170,000.

Calif., Chico—State of California, Sacramento, plans by Cole & Brouchard, 1st Natl. Bank Bldg., fireproof library and classroom building, on campus State Teachers College. $150,000.

Schools (Continued)

Calif., Fresno—State of California, Sacramento, plans by Swartz & Ryland, Brix Bldg., Class A library and administration building, at State Teachers College. $200,000.

Calif., San Jose—State of California, Sacramento, fireproof science building for State Teachers College. $202,000 appropriated.

Conn., Plymouth—Town, H. S. Fisher, supt. schools, high school, Terryille Sect. $150,000. Architect not selected.

Ill., Decatur — Bd. Educ., C. N. Weilepp, pres., South-West Junior High School, Oakland and Sunset Aves. Election about Feb. 15. $150,000, for same. Architect not selected. Noted Apr. 25, 1929.

Ind., Anderson—School Comrs., sketches new brick, steel consolidated school. $150,000. Architect not selected.

Ind., Hanover—Hanover College sketches steel, brick boys dormitory, on campus. $150,000. Architect not selected.

Ind., South Whitley—School Comrs. plans by Griffith & Goodrich, 209 Boss Blk., Ft. Wayne, brick, steel school. $150,000.

Ind., Valley Mills—Bd. School Comrs. plans by C. Byfield, Indianapolis, brick, steel consolidated high and grade school. $150,000.

Kan., Wichita—Bd. Educ., L. Gerteis, secy., 406 York Rite Temple Bldg., secy., sketches by E. Forsboom, Central Bldg., College Hill Grade School, brick, concrete, stone. $276,000.

Me., Brunswick — Town, K. C. Sills, chg. School Comn., 85 Federal St., altering and constructing 2 story, basement, brick high school addition. $150,000. Architect not selected.

Me., Gorham—State Normal School, W. E. Russell, principal, receiving competitive sketches 1 and 2 story, basement, gymnasium, auditorium. $150,000. Architect not selected.

Me., West Pownal—State School for Feeble Minded, P. E. Vosburgh, female dormitory, School Grounds. $175,000. Architect not selected.

Mass., Andover — Proctor Academy, Bd. Trustees, dormitory. $150,000. Architect not selected.

Mass., Boston—City, Dpt. School Buildings, 2 story, basement, brick, steel, limestone high school, Roslindale Sect. To exceed $250,000. Architect not selected.

Mass., Brighton (sta. Boston) — City of Boston, Dpt. School Building, soon takes bids 2 story, basement, brick, limestone school, concrete found., Kendrick St. $600,000. Allbright & Blaney, 308 Boylston St., Boston, archts.

Mass., Burlington—Town, Bd. Selectmen, J. A. Bustead, high school. $150,000-$160,000. Architect not selected.

Mass., Everett — City, School Comn., new school, Locust St. $150,000. Architect not selected.

Mass., Everett—City, School Comn., 2 story, basement, brick addition to Junior High School, Parlin St. $500,000 appropriated. Architect not selected.

Mass., Lee—Town, C. Miller, supt. schools, will not build brick, steel high school, during 1931. $150,000. M. W. Maloney, 23 Pearl St., Springfield, archt. Noted Sept. 4.

Mass., Lowell—Lowell Textile Institute, C. Eames, pres. Moody St., altering and constructing 3 story, brick chemistry department addition. $150,000 or more. Architect not selected.

Mass., Lynn—Dpt. Pub. Buildings, City Hall, Senior High School, 2 story, basement, West Lynn Sect. $250,000 or more. Architect not selected.

Mass., New Bedford — Mt. Carmel Roman Catholic Church, A. P. Vierira, pastor, 230 Binney St., school, Rivet St. $200,000. Architect not selected.

Mass., Norwood—Town, W. L. Grant, supt. schools, sketches by W. G. Upham, Bigelow Bldg., 2 story, basement, brick addition to Senior High School. $150,000. Noted July 31.

Mass., Springfield — St. Michael's Cathedral, G. Connor, pastor, 260 State St., high school. To exceed $150,000. Architect not selected.

Mass., Waltham—City, P. Duane, mayor, City Hall, altering and constructing 2 story, basement addition to Plympton School. $150,000 or more. Architect not selected.

Mass., Weymouth—Town, P. H. Tirrell, chn. Building Com., sketches by H. B. S. Prescott, 12 Pearl St., Boston, 2 story, basement, brick school, Weymouth Heights Sect. $150,000. Noted Feb. 5.

Mass., Winchester—Town, G. B. Hayward, 35 Everett Ave., Junior High School, 2 story, basement, brick, Main St. $390,000. Architect not selected.

Mich., Manistique—Bd. Educ., plans by R. V. Gay, Clinton St., St. Johns, 2 story, basement, 9 room, brick, steel, stone, rein.-con. school, incl. auditorium, gymnasium, plain found. $175,000.

N. H., Andover — Proctor Academy, C. B. Wetherell, academy, on campus. $150,000-$175,000. Architect selected soon.

N. J., Fair Lawn—Bd. Educ., 2 story, basement, brick, steel, rein.-con., school, Henderson Terrace Sect. **Maturity after July 1.** $150,000. Noted Sept. 11.

N. J., Irvington (br. Newark) — Bd. Educ., 1253 Clinton Ave., revised plans by Schneider, Kleeman & Werther, 1007 Broad St., Newark, altering and constructing 2 story, basement, brick, steel, Grove St. $150,000. Noted Jan. 8, under "Contracts Awarded."

N. J., Orange — Carteret Academy, 317 Carteret Pl., 2 story, basement, brick, steel, Orange St. $150,000. **Maturity about May.** Noted Jan. 15.

N. J., Pompton Lakes—Bd. Educ., J. Hutton, dist. clk., 96 Perrin Ave., revised sketches by J. Holt, 132 Market St., Paterson, 2 story, basement, brick, steel, rein.-con. high school. $200,000. Noted Feb. 5.

N. J., Springfield—Bd. Educ., Twp. Hall, 2 story, basement, brick, steel, South Springfield St. $150,000. F. A. Elsasser, 1000 Stuyvesant Ave., Union City, archt. Project in abeyance. Noted Jan. 1.

N. J., Union City—Bd. Educ., 415 32nd St., plans by F. A. Elsasser, 1000 Stuyvesant Ave., Union, 2 story, basement, brick, steel high school, plain found. $150,000 or more. **Maturity probably soon.** Noted Feb. 12.

N. Y., New York—O. R. Manowaski, Hotel Roosevelt, 45th St. and Madison Ave., 47 story office, store, 441 5th Ave. To exceed $1,500,000. **Maturity about Apr. 15.** Jardine, Murdock & Wright, 347 Madison Ave., archts. Will award without competition or by separate contracts. Noted Jan. 29.

N. Y., New York — Bd. Educ., 500 Park Ave., plans by W. C. Martin, archt. and supt. School Buildings, Flatbush Ave. extension and Concord St., Brooklyn, high school addition, Irving Pl., 16th and 17th Sts. $2,500,000.

N. Y., Ozone Park (br. Jamaica)—Bd. Educ., 500 Park Ave., New York, plans by W. C. Martin, archt. and supt. School Buildings, Flatbush Ave. extension and Concord St., Brooklyn, addition to P. S. 62, Chester Park, Woodhaven. $150,000.

N. D., Dickinson—Dormitory Corp., Dickinson State Normal School, S. T. May, pres., plans by I. L. Bush, Minot, 3 story, basement, 2 wings, rein.-con. brick, stone dormitory addition. $200,000.

Ore., Medford — City soon takes bids two schools. F. Clark, Medford, archt. $265,000 bonds voted. Noted Dec. 25.

Pa., California—Methodist Episcopal Bureau of Architecture, archts., 1701 Arch St., Phila., soon lets contract 3 story, basement, 60 x 100 ft., brick, hollow tile, educational and recreation building, incl. Sunday school, parish hall, mens locker rooms, bowling alley and game room, Liberty and 3rd Sts., for 1st Episcopal Congregation, H. A. Price, pastor.

Pa., Latrobe—Bd. Educ., Derry Twp., A. W. Long, secy., New Alexandria, plans by C. H. Sorber, 710 1st Natl. Bank Bldg., Greensburg, 2 story, basement, 60 x 85 ft., brick, tile, limestone school, near here.

Tex., Galveston — City, c/o Bd. Trustees, c/o H. W. Littlejohn, supt. schools, plans by R. R. Rapp, Guaranty Bldg., Junior High School, 2 story, brick, concrete. $350,000. Giesecke & Harris, Norwood Bldg., Austin, assoc. archts. Noted Jan. 22.

Ont., Toronto — Women's College Hospital, Surrey Pl., plans by Stevens & Lee, 62 Charles St. E., and takes bids in April, probably 4 story, basement, brick, stone, steel, concrete hospital, incl. 80 bed unit, operating rooms, kitchens, laboratory. $400,000.

Ont., Kingston—Kingston Collegiate Inst. Bd., C. Anglin, chn., new addition to collegiate institute. $250,000.

Ont., Toronto—Bd. Educ., 155 College St., plans by C. Dyson, 155 College St., 3 story, basement, brick, steel, stone, concrete, marble college addition, Bloor St., W. $220,000.

BIDS ASKED

Calif., Los Angeles—Bd. Regents University of California, 405 Hilgrade Ave., Westwood, taking bids 3 story, basement, 160 x 216 ft., Class A dormitory. $250,000. D. H. McLellan, Architects Bldg., archt.

Ill., Quincy—Mar. 12, by Bd. Educ., W. E. White, secy., 3 story, 6 story tower, rein.-con., brick, stone high school, incl. gymnasium, swimming pool, machine shop, kitchen, 14th St. near Maine St. $1,500,000. J. D. Chubb, 109 North Dearborn St., Chicago, archt. Behrensmeyer & Haffner, Western Catholic Union Bldg., assoc. archts. Noted Nov. 27.

Md., Baltimore—Feb. 25, by Bd. Awards, 2 story, irregular sized, brick, hollow tile school addition, Federal and Carter Sts. B. Frank, 517 North Charles St., archt. H. Massart, 328 North Charles St., engr.

Mich., Elkton—Mar. 4, by Bd. Educ., Dist. 1, 2 story, basement, brick, steel, rein.-con. high and grade school, plain found. $150,000. Lane, Davenport & Bennett, Charlevoix Bldg., Detroit, archts.

N. H., Exeter—Phillips Exeter Academy, L. Perry, taking bids 2 story, basement, 2 wings, brick, stone academy, plain found., College Campus. $150,000 or more. Cram & Ferguson, 248 Boylston St., Boston, Mass., archts. Noted Dec. 4.

N. J., Manasquan—Bd. Educ., bids about Apr. 1, 3 story, basement, brick, steel high school. $250,000. Coffin & Coffin, 522 5th Ave., New York, archts. Noted Dec. 25.

N. J., Phillipsburg—Feb. 25, by Bd. Educ., A. R. Case, secy., High School Bldg., 2 story, basement, brick, steel school, Ingersoll Heights. $150,000. A. Merchant & Son, 1 Elm Row, New Brunswick, archts. Noted Feb. 12.

N. J., Trenton—State Bd. Educ., State House, Annex, bids about Apr. 1, 2 story, basement, brick, steel, rein.-con. teachers college addition, Lake Blvd. $375,000. Guilbert & Betelle, 20 Branford Pl., Newark, archts. Noted Feb. 5.

N. J., Trenton—Mar. 14, by State Bd. Educ., State House Annex, auditorium and main recitation building at State Teachers College, Hillwood Lakes. $375,000. Guilbert & Betelle, 20 Branford Pl., Newark, archts. Noted Feb. 5.

N. Y., Queensboro Hill—Feb. 26, by W. C. Martin, archt. and supt. School Buildings, Flatbush Ave. extension and Concord St., Brooklyn, general contract P. S. 120, 136th St. from 58th Ave. to 58th Rd., for Bd. Educ., 500 Park Ave., New York.

O., Boardman — Feb. 24, by Bd. Educ., 3 story, basement, brick, steel, concrete high school. $150,000. Herman F. Kling & Son, 314 North Phelps St., Youngstown, archts.

O., Cleveland—John Carroll University, J. J. Bennett, chn. Building Comn., taking bids 2 and 3 story, stone, steel, concrete administration building, 2 dormitories, chapel, faculty and service buildings, Warrensville Center Rd. $2,000,000. Philip Lindsley Small, & Inc., Terminal Tower, archts. George S. Rider Co., Marshall Bldg., engrs. Noted Feb. 5.

Pa., Brentwood — Feb. 24, by School Dist. Brentwood Boro, 3 story, brick, steel, concrete high school. $200,000. H. W. Viehman & E. B. Lee, Chamber of Commerce Bldg., Pittsburgh, archts.

R. I., Middletown—St. George's School, c/o Howe & Church, archts., Turks Head Bldg., Providence, taking bids 2 story, basement, brick, stone infirmary, plain found. $150,000. Noted Sept. 11.

CONTRACTS AWARDED

Calif., Los Angeles—Los Angeles City School Dist., general contract 2 story, brick, concrete school, to G. Mittry, 816 West 5th St., $108,630. Noted Jan. 8.

Calif., Los Angeles—Los Angeles Bd. Educ., general contract 3 story, 75 x 315 ft. classroom and library, 2 story, 90 x 130 ft. cafeteria, 2 story, 75 x 180 ft. physical education building, 1 story, 78 x 155 ft. shop, to Sarver & Zoss, Roosevelt Bldg., $367,880.

Calif., Los Angeles—Los Angeles City School Dist., general contract brick, to Sarver & Zoss, Roosevelt Bldg., $329,705. Noted May 1.

Calif, Oakland—Oakland City School Dist., Fremont High School, 3 story, basement, steel, concrete, to C. D. Vezey & Son, 3220 Sacramento St., $398,848. Noted Dec. 25.

Ill., Alton—St. Marys Catholic Parish, c/o J. J. Brune, pastor, 3 story, basement, 51 x 123 ft. and 57 x 121 ft. school, 2 story, basement, 51 x 82 ft. sisters home, both irregular shaped, rein.-con., brick, to Bauer Bros. Constr. Co., 424 Lebanon Ave., Belleville, $77,981 and $28,444 respectively; plumbing and heating, to T. J. Fleming, Alton, $22,609; electric wiring, to Ernst Electric Co., Alton, $1,943. Grand total $130,977. Noted Dec. 18.

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Schools (Continued)

La., Luther—St. James Parish Bd. Educ., R. P. Lowery, supt., 3 story, basement, 117 x 151 ft., brick, stone high school, incl. science, auditorium, to Caldwell Bros., 816 Howard Ave., New Orleans. $109,408.

La., St. James—St. James Parish School Bd., R. P. Lowery, supt., 3 story, basement, 117 x 151 ft., brick, concrete high school, to Caldwell Bros., 816 Howard Ave., New Orleans. $100,898.

Mich., Detroit — C. A. Gadd, bus. mgr. Bd. Educ., 1354 Broadway Ave., general contract 2 story, basement, brick, steel, rein.-con., stone addition, to Rosewerne, McNabb & Worsick, 333 State St., $105,545; steam heating, to Drake Avery Co., 210 State St., $58,500.

Neb., Omaha—Bd. Educ., M. E. Bird, secy., general contract 3 story, basement, 115 x 181 ft., rein.-con., brick, stone addition to Central High School, to A. Beck, Keeline Bldg., $183,491; steam heating and plumbing, to J. J. Hanighen Co., 617 South 14th St., $37,822; electrical work, to E. C. Bennett Electric Co., 106 South 18th St., $12,426. Grand total $233,739. Noted Nov. 27.

N. J., Bridgeville—Bd. Educ., White Twp., W. Lantz, clk., general contract 1 story, 70 x 160 ft., brick, steel consolidated school, plain found., to J. H. Hoyt & Son, 700 Hamilton St., Easton, Pa. Est. $150,000. Noted Feb. 12.

N. Y., Rochester — Colgate Divinity School, general contract college divinity school, to Dwight P. Robinson Co., 125 East 46th St., New York. Est. $1,000,000. Noted Feb. 5.

N. C., High Point—City, Bd. School Comrs., T. W. Andrews, supt., Junior High School, brick, steel, concrete, marble trimmed, to R. K. Stewart & Son, High Point, $261,850; heating, to Crutchfield-Sullivan Co., Greensboro, $41,575. Noted Oct. 23.

O., Cleveland—Bd. Educ., F. G. Hogen, dir., 3 story, basement, 198 x 376 ft., brick, steel, concrete high school, to Aronberg-Fried Co., Midland Bank Bldg. Est. $900,000. Noted Jan. 8.

O., Painesville—Bd. Educ., E. Tucker, clk., two 2 story, basement, one 58 x 78 ft. and other 62 x 87 ft., brick, steel, concrete school additions, to Payne & Beymer, Painesville, $123,500. Noted Jan. 8.

Wis., Milwaukee — Bd. School Directors, excavating, grading, concrete work also masonry for Morgandale School, 3 story, to W. Christensen Constr. Co., 1419 6th St., Racine, $80,371 and $54,145 respectively; steel and iron, to Hockendohl & Schmidt, 16th and Canal Sts., $5,280; carpentry, to A. Lassanke, 709 12th Ave., Wauwatosa, $32,000; heating and ventilating, to Industrial Heating & Ventilating Co., 490 Bway., $33,792. Grand total $205,588. Noted Dec. 11.

THEATRES

PROPOSED WORK

Mass., Haverhill—M. and J. Bloomfield, 7 Howe St., plans by A. H. Dow, 192 Boylston St., Boston, and soon takes bids 2 story, basement, 115 x 210 ft., brick, limestone, concrete, steel theatre, store, office, concrete found., 153 Merrimac St. $300,000.

N. J., Red Bank — Owner, c/o Boylan & Levine, archts., 143 Albany St., New Brunswick, sketches 2 story, basement, brick, steel theatre. $150,000.

Ont., Ottawa—Triangle Amusement Co. Ltd., A. Nolan, mgr., Avalon Theatre, Bank St., brick, steel, rein.-con., stucco, plain found., Rideau St. $300,000.

BIDS ASKED

Mass., Boston—Adams House Realty Corp., H. K. Noyes, pres., 857 Commonwealth Ave., taking bids 1 story, basement, 80 x 200 ft., brick, concrete, steel theatre, plain found., Washington St. near Avery St., on Adams House Site. To exceed $150,000. A. H. Bowditch, 44 Bromfield St., archt. Noted Nov. 27.

BANKS

PROPOSED WORK

N. J., Newark—S. D'Auria & Sons, 139 7th Ave., Newark, sketches 2 story, basement, brick, steel bank, Clay and Broad Sts. $150,000.

N. J., Paterson—Bway. Bank & Trust Co., J. McCutcheon, pres., 120 Bway., will not build 2 story, basement, bank, Bway. and West Bway. Project abandoned. Noted May 22.

OFFICES

PROPOSED WORK

Ala., Birmingham — Liberty National Life Insurance Co., R. P. Davison, pres., 517 North 2nd St., plans by C. H. McCauley, Jackson Bldg., brick, stone office, Highland Ave. and Sycamore St. $500,000.

Ind., Indianapolis—Grain Dealers Mutual Insurance Agency, Inc., Guaranty Bldg., soon lets contract 3 story, basement, 40 x 64 ft., rein.-con., brick, stone, 1740 North Meridian St. $150,000. Rubush & Hunter, 1020 Architects Bldg., archts. Noted Feb. 5.

Mo., Springfield — Corporation, c/o W. H. Shepard, 638 Landers Bldg., sketches 8 or 10 story, basement, brick, stone, rein.-con. office. $500,000.

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N. J., East Orange—Baldwin Constr. Co., 614 Central Ave., revised sketches by Warren & Warren, 31 Clinton St., Newark, 2 story, basement, brick, steel office, stores addition, Central Ave. $175,000.

N. J., Paterson—Erie R.R. Co., G. S. Fanning, ch. engr., 50 Church St., New York, 10 story, basement, brick, steel office and railroad station, Ward St. $150,000. **Maturity in late fall.** Noted Nov. 13.

Que., Montreal—Canadian-General Electric Co. Ltd., 941 Inspector St., J. A. Fletcher, mgr., office and warehouse, near Beaver Hall Hill. $750,000.

CONTRACTS AWARDED

D. C., Wash.—District Comrs., District Bldg., general contract Stuart Junior High School, to W. R. Rose Co., Goldsboro, N. C., $160,000. Noted Feb. 5.

D. C., Wash.—Pub. Buildings & Pub. Parks, Navy Dpt., Red Cross Building, to McCloskey & Co., 620 Thompson St., Phila., Pa., $693,480. Noted Jan. 15.

Ill., Waukegan — A. Epstein, archt., 2000 West Pershing Rd., Chicago, masonry and carpentry contract 3 story, basement, 116 x 132 ft., brick, stone office, store and apartment building, for J. Blumberg, Waukegan, to M. Tietschman, Waukegan; electric wiring, to Warner Electric Co., Waukegan; plumbing, to T. J. Killan, Waukegan; heating, to F. C. Black Co., 622 West Randolph St., Chicago. Est. $200,000. Noted Jan. 8.

O., Columbus—Capital Square Corp., Columbus, general contract 9 story, gray Bedford limestone, polished black granite office and club building, 40 South 3rd St., to E. Elford & Son, 555 South Front St. American Educational Press, Inc., L. M. Sayre, pres. and University Club, Seneca Hotel, lessees. Noted Oct. 9.

Pa., New Castle—Burton Explosives, Inc., J. S. Burton, pres., Guardian Bldg., Cleveland, O., P. Forcey, in charge constr., 1 story, brick, steel laboratory and office building, near here. Owner builds and buys materials.

STORES

PROPOSED WORK

N. J., Newark—Bratter & Pollak, 972 Broad St., sketches by W. E. Lehman, 972 Broad St., Newark, 2 story, basement, brick, steel store, apartment, Clinton and Hillside Aves. $150,000.

N. J., Perth Amboy—Owner, c/o Greisen & Tuzik, archt., 175 Smith St., 2 story, basement, brick, steel store, office, Hobart St. $150,000.

N. Y., New York—Academy Housing Corp., 1750 Randall Ave., plans by Springsteen & Goldhammer, 40 East 49th St., 6 story, 65x136 ft. store, apartment, Commonwealth and Randall Aves. $275,000.

BIDS ASKED

N. J., Newark—See "Contracts Awarded."

N. J., Palisades Park — Owner, c/o P. J. Jossier, archt., 240 Broad Ave., bids about Mar. 1, general contract 2 story, basement, brick, steel store, apartment, Broad Ave. $150,000. Noted Feb 5.

N. Y., New York—C. Wagner, 697 East 132nd St., bids about Mar. 15, general and separate contracts 10 story store, office, Fordham Rd. and Grand Concourse. $1,200,000. N. Rotholz, 155 East 42nd St., archt. Noted Jan. 29.

CONTRACTS AWARDED

Calif., Los Angeles—F. and W. Grand-Silver Stores, Inc., 337 Bway., 6 story, basement, steel, concrete, to Bavin & Burch, 173 West Jefferson St., $229,945. Noted Feb. 5.

N. J., Newark—A. Radnevitz, 53 Chancello Ave., 3 story, basement, brick, steel store, apartment, 322-28 Osborne Terrace, separate contracts. $150,000. C. F. Ackerman, 45 Clinton St., archt. Noted Feb. 12.

O., Cleveland—May Co., S. L. Gross, treas., 2 story, 194 x 499 ft., terra cotta, steel, concrete top addition to department store, to Aronberg-Fried Co., Terminal Tower. Est. $1,000,000. Noted Feb. 5.

PUBLIC

PROPOSED WORK

Ark., Russellville — COURT HOUSE — Pope Co., c/o H. M. Spaulding, clk., plans by H. R. Burks, Wallace Bldg., Little Rock, 3 story, basement, 54 x 120 ft., rein.-con., concrete. Election Feb. 24, $150,000 for same.

Calif., Los Angeles—HALL of SCIENCE and OBSERVATORY—City of Los Angeles (Bequest Col. Griffith) sketches Class A hall of science and observatory building, Mt. Hollywood St. $750,000.

Me., Houlton—JAIL—Aroostock Co., Comn., S. P. Archibald, chn., Houlton, county jail. To exceed $150,000. Site and architect not selected.

Mass., Boston — LIBRARY — City, Library Dept., Copley Sq., F. W. Buxton, pres. Bd. Trustees, branch library, Jamaica Plain, Boylston Sect. $200,000. Architect not selected.

Mass., Brighton (br. Boston)—LIBRARY—City of Boston, Library Dpt., Copley Sq., F. W. Baxter, chn. Bd. Trustees, branch library, Faneuil Sect. $200,000. Architect not selected.

N. H., Franklin—ARMORY—State, W. A. Stone, State House, Concord, armory. To exceed $150,000. Architect not selected.

N. J., Keyport — MUNICIPAL — Bd. Town Council, 2 story, basement, brick, steel, Main St. $150,000. Architect not selected.

N. J., Newark — ORPHANAGE — Daughters of Israel Hebrew Orphans Sheltering Institution, 12 Homestead Park, raising $150,000 funds 3 story, basement, brick, steel orphanage. I. Kosoff, 164 Market St., archt. **Maturity probably in April.** Noted Jan. 29.

N. J., Newark—MARKET—Newark Farmers Market, Inc., A. Von Der Vliet, dir., 58 Terhune Ave., Lodi, market. $400,000. Architect not selected.

N. J., Paramus (mail Ridgewood) — DETENTION HOME—Bd. Freeholders Bergen Co., Court House, Hackensack, will not build 2 story, basement, brick, steel detention home. $150,000. Architect not selected. Project abandoned. Noted Oct. 31.

N. J., Red Bank—LIBRARY—Bd. Boro Council, Boro Hall, 2 story, basement, brick, steel. $150,000. **Maturity indefinite.** Noted Jan. 29.

N. Y., Astoria—HEALTH CENTER—Dpt. Health, 505 Pearl St., baby health center, X-ray laboratory, dental clinic. $150,000.

N. Y., Brooklyn—HEALTH CENTER—Dpt. Health, 505 Pearl St., New York, 3 story baby health center, X-ray laboratory, pharmacy, dental clinic. $150,000.

N. Y., New York—HEALTH CENTER—Dpt. Health, 505 Pearl St., bids early in April, general contract baby health center, X-ray laboratory, dental clinic, 349 East 140th St. $150,000. K. Murchison, 101 Park Ave., archt. Noted Feb. 11 Daily.

N. Y., St. George — BORO HALL — J. A. Lynch, pres. Richmond Boro, Boro Hall, 4 story, basement, brick, steel, Bay St. $600,000. **Maturity after Mar. 1.** F. E. Wall, 576 Oakland Ave., West New Brighton, archt. Noted Dec. 25.

N. Y., St. George—HEALTH CENTER—Dpt. Health, 505 Pearl St., New York, 3 story baby health center, X-ray and dental laboratories. $150,000. Architect not selected.

Nev., Las Vegas—COURT HOUSE—Comrs. Clark Co. receiving competitive plans for court house annex. $150,000. Noted Feb. 5.

Okla., Enid—COURT HOUSE—Garfield Co., sketches rebuilding 4 story, basement, rein.-con., brick, Bway. $350,000. A. Lewis, co. clk.

Pa., Franklin—COURT HOUSE—Bd. Comrs. Venango Co., Z. Smiley, clk., 2 story, basement addition, Elk St. $150,000. Architect selected soon. Noted Apr. 17.

Tex., Beaumont—FIRE STATIONS—City, c/o P. Millard, soon takes bids 3 fire stations, equipment. $200,000 bond issue available. Babin & Neff, Beaumont, archts.

Que., Hull—COURT HOUSE, etc.—Hull Co. plans by Provincial Government, new court house, jail, Main St. $350,000.

BIDS ASKED

Kan., Goodland—COURT HOUSE—Feb. 24, by C. W. Jupe, clk, Sherman Co., 3 story, basement, 70 x 107 ft., rein.-con., brick, Bedford stone, terra cotta. Rutledge & Hertz, 204 State Exch. Bank Bldg., Hutchinson, archts. Noted Jan. 8.

Mich., Mount Clemens—COUNTY—Feb. 24, by I. A. Hartung, clk. Macomb Co., 10 story, basement, brick, steel, rein.-con., plain found., Gratiot and Broadway Aves. $750,000. G. J. Haas, 601 East Grand Blvd., Detroit, archts.

R. I., East Providence (br. Providence) — FIRE STATIONS — Town, W. E. Smythe, town clk., taking bids two 2 story, basement, brick, steel, plain founds., 1 at Central Station 1, and other Rumford Dist. 3. $150,000. M. Traficante, 175 Taunton Ave., archt. Noted Jan. 22.

Tex., Menard—COURT HOUSE—Mar. 8, by Menard Co., c/o County Judge, general contract 4 story, basement, 80 x 104 ft., monolithic concrete, stone, Square. $150,000. Withers & Thompson, 201 Holmes Bldg., Fort Worth, archts. Noted Jan. 8.

CONTRACTS AWARDED

Kan., Alma — COURT HOUSE and JAIL — Wabaunsee Co., D. R. Abbott, clk., general contract 3 story, ground floor, 69 x 103 ft., rein.-con., brick Bedford or Carthage stone, to Shuss & Henderson, Larned, $106,831; plumbing and heating, to Emporia Plumbing & Heating Co., 710 Commercial St., Emporia, $14,800; wiring, to Larsons Electric Shop, Wamego, $5,094. Grand total $126,725. Noted Jan. 8.

Wis., Milwaukee — COURT HOUSE — Milwaukee Co., special interior furnishing for county court house, to Matthews Bros. Mfg. Co., Port Washington, $299,000; marble work, to Andrews Stone & Marble Co., 110 Keefe Ave., $40,850.

Va., Richmond—HOME—Bd. Comrs. Home for Needy Confederate Women, 3 East Grace St., new home, to A. J. Saville, Inc., 7th and Franklin Sts., $243,830. Noted Jan. 29.

Que., Montreal—FIRE STATION—City, new fire station in St. Johns Ward, Shamrock and Drolet Sts., to G. Archambault, $170,000. Noted Jan. 2.

Que., Montreal—POLICE and FIRE STATION—City, J. E. Gauthier, clk., 3 story, 65 x 150 ft., rein.-con., brick, stone, Shamrock and St. Dominique Sts., to G. C. Gaspard Archambault, 1584 Clarke St., $155,800. Noted Nov. 27.

UNCLASSIFIED

PROPOSED WORK

Md., Baltimore — PUBLISHING PLANT — Scripps Howard Publications, 230 Park Ave., New York, and Baltimore Post, will not rebuild publishing plant, recently destroyed by fire. To exceed $150,000. Project abandoned. Noted Jan. 15.

Unclassified (Continued)

BIDS ASKED

Conn., Greenwich—HOME—St. Luke's Convalescent Home. G. F. Clover, supt., plans by W. S. Gregory, 180 Madison Ave., New York, 2 story, basement, 50 x 90 ft., brick, cast stone, steel convalescent home for children. $150,000. **Maturity about April.**

Md., Baltimore—AUDITORIUM—Feb. 21 (extended date), by Tall Cedar Building Corp., c/o B. Evander, archt., 20 East Lexington St., 1 story, mezzanine, balcony, brick, hollow tile, cut stone, 1207-15 North Charles St. $150,000. Noted Feb. 5.

N. J., Hackensack—EXCHANGE—New Jersey Bell Telephone Co., 540 Broad St., Newark, bids about Apr. 15, general contract telephone exchange, State St. $150,000. Voorhees, Gmelin & Walker, 101 Park Ave., New York, archts. Noted Feb. 12.

CONTRACTS AWARDED

Conn., New Haven—BUSINESS—Yale News, Yale University, New Haven, 3 story, stone building for Yale News as Britton Hadden Memorial, York St., to Sperry and Treat, 294 Kimberly Ave. Est. $150,000.

Ind., Indianapolis — EXCHANGE — Indiana Bell Telephone Co., 256 North Meridian St., general contract 7 story, basement, 90 x 195 ft., rein.-con., limestone, to L. Colvin, 803 Continental Bank Bldg. Total est. $1,000,000. Noted Jan. 29.

Industrial Buildings

FACTORIES AND MILLS

PROPOSED WORK

Calif., Coalinga—BOOSTER PLANT—Associated Oil Co., Avon, and P. E. Bldg., Los Angeles, subsidiary Tide Water Associated Oil Co., 17 Battery Pl., New York, sketches booster plant. To exceed $50,000. **Maturity indefinite.**

Del., New Castle — STEEL PLANT — Intercontinental Pipe & Mining Co., c/o Herbert Kennedy Cast Iron Pipe Co., 122 East 42nd St., New York, reconditioning, equipping plant. $1,000,000.

Mass., Chelsea (br. Boston) — MANUFACTURING, etc.—Inter-Continental Pipe & Mining Co., c/o Herbert Kennedy Cast Iron Pipe Co., 122 East 42nd St., New York, manufacturing building, incl. wharves. $3,000,000. Project abandoned. Noted Aug. 1, 1929.

N. J., Elizabeth — SHIRT FACTORY — L. Quien, archt., 229 Broad St., soon lets general contract altering and constructing 2 story, basement, 35 x 100 ft., brick, steel addition, 5th and Fulton Sts., for Fordham Shirt Co., Fulton St. $40,000. Noted Jan. 8.

N. J., Newark—FACTORY—Unique Art Mfg. Co., 196 Waverly Ave., plans by S. Shaw & Co., engrs. and archts., 24 Commerce St., altering 2 story, basement, brick, steel, 196 Waverly Ave. $40,000.

N. Y., Buffalo—FACTORY—American Lithographic Co., 601 Amherst St., Buffalo, and 52 East 19th St., New York, soon lets contract plant addition, Elmford Ave. To exceed $40,000.

N. Y., New York—MANUFACTURING—Five Hundred Eleven to Nineteen Faile Street Realty Co., 511 Faile St., 1 story, 99x100 ft. factory. $40,000. Private plans.

N. Y., New York—CARPET CLEANING FACTORY—One Hundred Thirty-Five East 144th St. Corp., P. B. Williams, 353 West 54th St., soon lets contract factory, Walton Ave. and 144th St. $90,000. J. M. Lake, 415 Lexington Ave., archt.

Tex., Presidio — CREOSOTING PLANT — Atchison, Topeka & Santa Fe R.R. Co., W. W. Kelly, ch. engr. (Western Lines), Amarillo, creosoting plant. $100,000. Project in abeyance. Noted Jan. 15.

Tex., San Antonio — BAKERY — El Fenix Bakery, c/o J. Estrada, 201 South Laredo St., plans by L. M. J. Dielmann, 306 East Commerce St., 1 story (ultimately 2 story) 70 x 140 ft., brick, rein.-con. addition, plain found. $100,000, incl. machinery, equipment. Noted Dec. 25.

Ont., London—BREWERY—Labatt Brewery Co. addition. $100,000.

Ont., Toronto — BRASS PLANT — Toronto Brass Machine & Fdry. Ltd., 74 Market St., plans by J. A. Thatcher, 37 Cowan Ave., 1 story, brick, concrete, steel, Leslie St. $40,000-$50,000.

BIDS ASKED

Calif., Santa Paula — PACKING PLANT — R. C. Wilson, archt., 112 South Mill St., taking bids 2 story, basement, 100 x 250 ft., rein.-con., for Mupu Citrus Assn., c/o architect. $100,000.

Ind., Vincennes — BAKERY PLANT — See "Contracts Awarded."

Mass., Cambridge — CLEANSING PLANT — H. J. Shea & Co., c/o W. L. Gavon, archt., 30 Brattle St., taking bids 1 story, basement, 60 x 100 ft., brick, steel, plain found., Mass Ave. opposite Ellery St. $40,000. Noted Feb. 5.

N. J., Jersey City—DISTRIBUTING PLANT—Sheffield Farms Co., Inc., H. McNabb, in charge, 524 West 57th St., New York, taking revised general contract bids 1 story, basement, brick, steel addition, Ocean Ave. $150,000. F. A. Rooke, 12 East 41st St., New York, archt. Noted Jan. 29.

N. J., Jersey City — FACTORY — B. Singer, archt., 921 Bergen Ave., bids about Mar. 15, general contract 2 story, basement, 45 x 140 ft., rein.-con., brick, steel, foot Crawford St., for Jersey City Ladder Co., Inc., 677 Montgomery St. $50,000. Noted Jan. 22.

N. J., Wallington—BAKERY—J. T. Camlet, archt., 26 Piaget Ave., Clifton, new bids about Mar. 1, general contract 2 story, basement, brick, steel bakery plant, store, garage, Wallington Ave. and Mercer St., for J. Borbuta, 103 Halstead St. $40,000. Noted Feb. 12.

N. Y., New York—LIGHT MANUFACTURING—H. C. Young, 37 Murry St., bids about Mar. 1, general contract altering 5 story, 37 Murry St. $40,000. J. Fisher, 45 Astor Pl., archt. Noted Jan. 29.

Ore., Portland — FACTORY — See "Contracts Awarded."

CONTRACTS AWARDED

Calif., Los Angeles—FACTORY—Coca Cola Bottling Wks., 1334 South Central Ave., 2 story, 72 x 150 ft., plaster, steel, brick addition, to W. P. Neil Co., 4814 Loma Vista St.

Calif., Stockton — BAKERY — Kerns Bakery Plant, 448 North Point St., brick additions, North Point St., to L. P. Peletz, 1660 West Acacia St., $40,000.

Ind., Vincennes—BAKERY PLANT—G. W. Opell Co., brick, steel, glazed tile bakery plant, 1910 North 2nd St., separate contracts. $42,-000. Sutton & Routt, Vincennes, archts.

N. Y., New York—MIXING BINS—Consolidated Gas Co., Irving Pl., 2 steel concrete bins, to Koppers Constr. Co., Koppers Bldg., Pittsburgh, Pa. Est. $40,000. Noted Jan. 29.

O., Cleveland—WIRE MILL—General Electric Co., River Rd., Schenectady, N. Y., (1 unit) 322 x 412 ft. unit of wire mill, to Austin Co., 16112 Euclid St. Est. $1,000,000. Total est. of 3 units $3,000,000.

Okla., Ponca City—REFINERY—Continental Oil Co., petroleum refining (oil distillation), to Alco Products Co., subsidiary of Amer. Locomotive Co., Dunkirk, N. Y. Est. exceeds $40,000.

Tex., Beaumont—BAKERY—Fehr Baking Co., 4104 Leeland St., Houston, bakery, Laurel Ave. at 11th St., $50,000. Owner builds, R. Brenton, constr. supt. C. J. Patterson, 4050 Penn St., Kansas City, Mo., engr.

Ore., Portland — FACTORY — Beaver Wood Products Co., S. R. Smith, pres., 1 story, 48 x 258 ft., Steel Ave., 24th and 25th Sts., day labor. $41,000. H. M. Rigler, Spaulding Bldg., archt. Noted Feb. 5.

GARAGES

PROPOSED WORK

N. J., Clifton—H. Holder, archt., 242 Franklin Ave., Brooklyn, soon lets general contract 1 story, basement, 200 x 235 ft., brick, steel garage, stable, Broad and Warren Sts., for Dugan Bros., Inc., 161 Arlington Ave., Newark. Est. $150,000.

N. Y., Brooklyn—Bayridge Fireproof Storage Co., c/o A. Kaiser, 322 9th St., bids late in fall, general and separate contracts 105x160 ft. service garage, gas station and shops, 5th Ave. and 63rd St. $125,000. H. G. Harrington, 311 100th St., archt. Noted Jan. 29.

N. Y., Brooklyn—R. E. W. Realty Co., Inc., 160-09 Jamaica Ave., Jamaica, bids about November, general and separate contracts garage and service station, 20th Ave. and 7th St. $45,-000. M. Marlo, 200 Beverly Rd., archt. Noted Jan. 29.

N. Y., Brooklyn—D. H. Yeoman, 89-15 187th St., Hollis, bids late in fall, general and separate contracts service garage, 54th St. and 21st Ave. $50,000. J. A. Boyle, 367 Fulton St., archt. Noted Nov. 20.

N. Y., New York—Dpt. Parks, W. J. Herrick, pres. Park Bd., Arsenal Bldg., Central Park, plans by J. Dusenbury, 2382 Grand Concourse, 2 story garage and office, Birdall Ave. and Bronx Park. $125,000.

BIDS ASKED

Mass., Belmont—Town, Electric Light Dpt., Concord Ave., taking bids 1 story, 50 x 110 ft., concrete garage, storeroom. $45,000. Private plans.

N. Y., Long Island City—Feb. 26, by Sanitary Comn., Municipal Bldg., New York, W. Schroeder, Jr., comr., garage, 21st St. and 35th Ave.

R. I., Providence—See "Contracts Awarded."

CONTRACTS AWARDED

R. I., Providence — M. Gordon, Hospital Trust Bldg., 1 story, 80 x 180 ft., brick, steel repair garage, service station, plain found., 34-36 Branch Ave., separate contracts. $50,000. H. Castor, St. Girard Bldg., Phila., Pa., archt.

SHOPS AND FOUNDRIES

PROPOSED WORK

N. J., Roselle—MACHINE SHOP—Hubeny Bros., 615 East 1st Ave., 1 story, basement, brick, steel addition. $40,000. **Maturity in April.** W. L. Finne, 1201 East Grand St., Elizabeth, archt. Noted Feb. 5.

N. Y., New York—SHOP—Consolidated Gas Co., 4 Irving Pl., plans by J. F. Hunter, c/o owner, 3 story shop, 500 East 63rd St. $350,000.

N. Y., New York — WORKSHOP — Ranco Realty Corp., B. Alpren, pres., 5271 Tiffany St., sketches by N. Rotholz, 155 East 42nd St., 1 story, 100x100 ft., Tiffany St. and East Bay Ave. $40,000.

POWER PLANTS

PROPOSED WORK

Calif., Tulare — Tulare Pub. Utility Bd. authorized city to make survey municipal light plant. $3,000,000.

Mass., Taunton — Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, boiler room improvements at State Hospital. $40,000.

O., Shelby—City, sketches light and power plant improvements. $225,000. Burns & McDonnell Eng. Co., 400 Interstate Bldg., Kansas City, Mo., engrs. Noted Jan. 8.

Tex., Eagle Pass — Central Power & Light Co., San Antonio, c/o Natl. Bank of Commerce Bldg., complete plans, specifications now being drawn and preliminary survey work started for 10,000 hp. hydro-electric plant in either 2 or 3 units, on irrigation canal near Rio Grande River, near here. $1,500,000. Harza Eng. Co., 20 North Wacker Dr., Chicago, Ill., engrs. Noted Jan. 29.

Virginia—Virginia Electric & Power Co., 7th and Franklin Sts., Richmond, expending $4,000,000 during this year for improvements, incl. booster station, electric line extensions, new busses for bus line service, garages, in Richmond, Petersburg, Norfolk, Portsmouth and Fredericksburg.

CONTRACTS AWARDED

Ia., Ft. Dodge—Ft. Dodge Gas & Electric Co., T. C. Roderick, mgr., 2 story, 35 x 65 x 75 ft., concrete, steel, brick power plant addition, to United Light & Power Eng. & Constr. Co., c/o owner. Est. $65,000. Equipment $135,000.

Ia., Grundy Center—Northwestern Light & Power Co., 40 x 80 ft., brick, concrete power plant addition, 64 ft. high, to Zittrel & Mills, Webster City.

Mass., Westboro—New England Power Assn., 89 Broad St., Boston, sub-station, to New England Power Constr. Co., 89 Broad St.

N. D., Williston—Great Northern Ry. Co., J. R. W. Davis, ch. engr., St. Paul, Minn., superstructure 64 x 94 ft., brick, steel power plant, to C. U. Steen Co., Grand Forks. Est. $80,000. Noted June 12.

Tex., Yoakum—See "Power and Lighting"

B. C., Kaslo—City, constructing electric light and power plant, incl. dam, new 300 hp. automatic control turbine, direct connected 4o generator, switchboard, instruments, to Electric Power Equipment Ltd., 1285 Homer St., Vancover, $40,525.

Man., Churchill — Dominion Government, power plant building at terminus Hudson Bay Railway, to Carter Halls Aldinger & Co., Winnepeg, $174,000.

Que., Masson—MacLaren-Quebec Power Co. of Canada Ltd., Buckingham, 130,000 hp. power plant, incl. dam, control works, intake on Lievre River, and tunnel 25 ft. diam. and over 1 mi. long, to Foundation Co. of Canada Ltd., 1538 Sherbrooke St. W., Montreal, Que., and Ottawa, Ont.

WAREHOUSES

PROPOSED WORK

Mass., Boston — Boston Wharf Co., 259 Summer St., plans by H. B. Prescott, 259 Summer St., 6 story, basement, irregular sized, brick warehouse, fire repairs, 35 Sleeper St. $40,000 or more.

N. J., Camden — South Jersey Port Comn., U. S. Jeffery, secy., 106 Market St., 2 story, basement, 160 x 300 ft., brick, rein.-con. warehouse, Delaware River front between Clinton and Pine Sts. $500,000. Project in abeyance. C. W. Stamford, 50 Church St., New York, engr. and archt. Noted Dec. 18.

CONTRACTS AWARDED

Conn., Rocky Hill — Connecticut Terminal Corp., 22 Charter Oak Ave., Hartford, 1 story, 40 x 150 ft., brick, steel terminal building, incl. storage, service. Connecticut River, to N. Levitsky, 49 Acton St., Hartford. Est. $40,000.

Minn., Minneapolis—Chicago, Milwaukee, St. Paul & Pacific R.R. Co., C. F. Loweth, ch. engr., Union Sta., Chicago, Ill., general contract 1 story, basement, brick, steel fruit storage, 9th Ave. and 2nd St., to Pike & Cook, 416 South 5th St. Est. $100,000.

Minn., St. Paul — Chicago, Milwaukee, St. Paul & Pacific R.R. Co., C. F. Loweth, ch. engr., Union Sta., Chicago, Ill., general contract 1 and 2 story, 1st floor 75 x 300 ft., 2nd floor 50 x 75 ft., brick, timber freight terminal Prior Ave. and railroad tracks, to C. F. Haglin & Sons Co., 920 Natl. Bldg., Minneapolis. Est. $150,000. National Freight Co., 510 Hodgson Bldg., Minneapolis, lessee.

See proposal advertising on page 104

Const. News page 79

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